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Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

Indexes for the previous 6 months will be found in the First number of July and the First number of January.

Collections are invariably made directly from this office for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Eighth Annual Convention, Wisconsin Gas Association.

WISCONSIN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
RACINE, WIS., April 27, 1909.

To the Members, Wisconsin Gas Association: The eighth annual convention of the Wisconsin Gas Association will be held in Milwaukee. May 12th and 13th. The convention will be called to order by the President, Mr. David Douglas, of Eau Claire, at 10 A.M. of Wednesday, the 12th inst.

Respectfully yours,
HENRY H. HYDE, Secretary.

[NOTICE.]

Wrinkle Department, American Gas Institute.

WRINKLE DEPARTMENT, AMERICAN GAS INSTITUTE,
OFFICE OF EDITOR, GAS OFFICE BUILDING,
DETROIT MICH, March 12th, 1909.

To the Members, American Gas Institute: All members of the American Gas Institute are earnestly requested to forward contributions for the Wrinkle Department as soon as possible.

Your co-operation determines the success of the Department.

F. L. CROSS, Editor.

BRIEFLY TOLD.

MUNICIPAL ART EXHIBIT AND ILLUMINATING ENGINEERING.—We received with pleasure an announcement concerning an exhibit, to be held in the 22d Regiment Armory, for two weeks, beginning May 3d, on Municipal Art, and of especial interest was to be the proposed exhibit of the Illuminating Engineering Society. Knowing the great interest that the gas fraternity are taking in lighting matters in general, we take this opportunity to inform them that the exhibit consists of a number of photographs of more or less grotesque, or, as some would say, *ornamental* street lighting fixtures in Washington, D. C., and also some night scenes from Denver, Col., and Scranton, Pa. The booths are illuminated by incandescent lamps fitted with reflectors, which allow a goodly portion of the light to shine in one's eyes and also succeed in shutting off some, which would otherwise light the aforesaid Illuminating Engineering exhibit. The general illumination of the hall is furnished by a large number of flaming arc lamps, of a candle power which mere figures could not adequately proclaim. Their sputtering and blinking are reminders of the "restful effect" which gazing at moving pictures produces. There is a most interesting exhibit of street lighting fixtures, placed close together in an aisle about 8 feet wide, so that, even if you may with difficulty examine each of the dozen odd exhibits, you can see them all at once. The central portion is given over to a court of honor, where persons in the public eye may hold forth. It's a long hark from May till November, but they will have a long rest; and, too, [illegible] sometimes come the spoils.—SPECTATOR.

LIBRARY OF CONGRESS
MAY 10 1909
SMITHSONIAN DEPOSIT.

OUR HALF-CENTURY SPECIAL NUMBER.

Next month we complete our Fiftieth Year. To commemorate it fittingly the proprietors have determined to print a special issue, on the pages of which will be given a fair history, and at some length, of the progress made in the gas industry since the JOURNAL first appeared to champion the cause. The issue is to have 100 pages, with special cover, the size of the pages to be even with those in the regular edition. One-half the issue (50 pages) will be given to the publication of articles (14 in number) on the leading phases of gas manufacture and distribution, the sketching of the articles to be historical. These articles are in course of preparation by men whose eminence in the profession cannot be gainsaid, and each of them is addressing himself to a subject regarding which he undoubtedly possesses expert knowledge. The remainder of the issue will be given over to advertising, the rates for which are as follows:

One page $50.
One-half page $25.
One-quarter page $13.

The cover pages, inside and out, have been engaged (these were let at figures approximately 200 per cent. higher than the "inside,") and 31 of the interior pages have also been contracted for. The edition will go free to everyone of our regular subscribers and advertisers, and extra copies will be furnished at the rate of 50 cents each. No concession in price will be made for orders for extra copies to anyone. Those who desire to advertise, and those who wish to secure extra copies, should address the publishers at once. No undue claim to excellence is made when it is stated that this special issue will contain more in value to the fraternity than was contained in any other issue of any gas news periodical ever printed.

[Continued from Page 774.]

Review of the Twenty-Fourth Annual Report, Massachusetts Board of Gas and Electric Light Commissioners.—No IV.

[Prepared for the JOURNAL, by MR. H. THURSTON OWENS.]

Meter Inspection.—The number of meters inspected was slightly smaller than in former years, totalling 58,875 as against 103,236 in the Second District of New York State. Curiously the number of prepayment meters examined in Massachusetts was less than one-half that for the previous year, 26,391 and 11,737, respectively. The number of meters tested upon complaint was 438, being about the same in number as for the two previous years. Comparing the number of meters tested on complaint with those tried on similar account in New York State the results are as follows:

Massachusetts, percentage of total	0.7
New York, First District, percentage of total	1.2
" " Second " " "	0.2

In stating the number of meters which were correct the Massachusetts Board has not omitted those within 2 per cent. either way, as in the case of the Commission in New York city. The average error of all the meters which would pass gas (432) was 1.65 per cent. fast and 46.06 per cent. were correct, as against 41.81 per cent. for 1907.

As an indication of the greater requirements for individual consumers, it is to be noted that the number of all sizes tested, other than 3-light, show an increase over the previous year.

The profit from gas meter testing fees amounted to $2,012.76, whereas 20 electric meters were tested at an expense to the State of $281.24, as against $181.19 for the previous year.

Output.—The coal gas, meaning all except acetylene and oil gas made and bought by all of the companies in the Commonwealth of Massachusetts, for the year 1908, was, in round figures, 11½ billions cubic feet, being an increase as to the previous year of over 8 per cent. This is about the same as the make of the Brooklyn Union Gas Company, of New York, or slightly less that one-quarter of the gas made in the city of London, and about double that of the city of Manchester. Comparing the totals of 1906, 1907 and 1908, we find the following results:

	Increase in Per Cent. 1907 over 1906.	Increase in Per Cent. 1908 over 1907.
Gas made	18	9
Gas bought	2 (decrease)	8
Gas sold by meter	11	8.8
Gas sold for public lamps	6	7

In only two companies in the State does the output exceed the amount used for public street lamps in the city of New York.

In 1907 five companies made less gas than the previous year, while unaccounted-for in 1908 there were eight. The unaccounted-for shows increase of slightly over 2 per cent., as against an increase of gas made and bought, of 8 per cent.

In 1907 twenty eight companies showed a larger percentage of unaccounted-for than in the previous year, while in 1908 there was one more, or 29.

The company showing the largest percentage in 1907 was Stoneham, with 29.03 per cent, and this Company again leads in 1908, with 31.59 per cent. The figures respecting Boston for the last 3 years show an increase each year—1.52, 3.69 and 5.16 per cent., respectively.

Sendout. The largest sendouts in six companies exceeded their daily capacity as against nine for 1906. There were eleven companies with a maximum day of over 1 million, as against only 8 for the previous year. Boston reaching over 17 million on December 24th.

Sales and New Mains.—The two companies showing the largest percentage of increase in sales in 1907, appear again in 1908. The companies with over 30 per cent. in 1908, and also Boston, are given in Table I.

TABLE I.—*Showing Increase in Sales and Pipe Laid.*

	Percentage of Increase. 1907 Over 1906.	Percentage of Increase. 1908 Over 1907.	Feet of Pipe Laid. 1907.	Feet of Pipe Laid. 1908.
Quincy	71.47	51.43	89,707	113,233
Worcester County	95.30	43.19	81,207	41,595
Malden	20.31	34.03	111,623	37,874
Greenfield	18.25	31.46	19,958	3,850
Revere	31.19	30.17	19,419	30,221
Boston	7.76	6.67	88,184	115,964

Seven companies show a decrease in sales against three for 1907. Ipswich leading, with Cottage City second for both years.

All of the oil gas, and one-third of the acetylene companies show a decrease, and the municipal plant at Middleborough also shows a decrease for both 1907 and 1908.

Sales and Unaccounted-for per Mile of Main.—The companies selling over 4 million per mile of main numbered six in 1908, against only three for the previous year, and the figures for the former, with the unaccounted-for, are given for 1907 and 1908.

TABLE II.—*Showing Sales and Unaccounted-for per Mile of Main.*

	Sales. 1908.	Sales. 1907.	Unaccounted-For. 1908.	Unaccounted-For. 1907.
East Boston	5,368,231	5,137,409	173,976	260,469
Boston	5,237,800	5,039,368	285,931	194,183
Fall River	4,188,633	3,968,781	320,843	295,167
Cambridge	4,132,993	3,895,972	390,958	862,401
Charlestown	4,033,614	4,798,989	469,444	316,596
Lynn	4,019,422	4,222,921	193,478	324,350

Regarding sales, Lynn has dropped back from third to sixth place, but Mr. Gifford has increased his lead despite the pyrotechnics across the river. The sales and unaccounted-for per mile of main in Greater New York for 1907 were 9,591,000 and 525,000, respectively.

Consumers per Mile of Main.—The largest number of consumers per mile of main is to be found at Holyoke, with 188.1; East Boston following with 186.6; Boston is seventh, with 137.4.

Sales per Consumer.—There were 5 companies with over 30,000 cubic feet per consumer in 1908, against only 2 for the pravious year. Boston leads with over 33,000. The highest figures from New York city for 1907 were 37,000, and the average for the whole city was 29,000. No report for 1908 is available at the present time, and will probably not be for some time to come, as the 1907 figures were published 1½ years after their dating. The average sales per consumer in London for 1907 were 38,554.

Sales per Capita.—No figures are presented under this caption, although they would prove most valuable. The rather meaningless data on sales per meter light have been abandoned, and the one suggested would undoubtedly be welcomed.

Street Mains.—There were only 86 miles of mains laid, as against 211 for the previous year, Boston leading with about 22 miles.

Meters.—There were eight companies which showed an increase of over 1,000 meters in 1908, against six for 1907, but the leader in the former year (Boston) with over 6,000, showed a decrease of 14 in 1908. The largest increase in 1908 was at Malden, with 2,030. The total increase of meters in 1908 was 19,214, against 31,128 in 1907.

Gas Stoves.—The figures covering the number of gas stoves in use were presented with an apology as to their correctness in 1907. Boston then estimating that there were about 50,000 in use. The calculations were evidently too enervating for the official new business promulgator of West street, for no figures for Boston are given for 1908, although we presume that there are a few stoves in use. No apology is presented for the figures from the other companies, and they all show substantial increases. Lynn leads with nearly 24,000, which figure represents 1.2 stoves per meter—a regular hotel business.

Increasing Market for Coke.

[Communicated by "R."]

The writer recently visited Cuba, which is certainly a great charcoal and coke country. The people do not use ranges for cooking or other purposes; the stoves being constructed out of slabs of stone and metal, and coke or charcoal fuel is burned on these slabs. The smoke goes out through an opening in the side of the house wall by means

Coke Work, Near Havana, Cuba.

of a type of chimney, in some cases, and by means of a simple hole in others. Because of the fact that coke and charcoal are used in this manner, the marketing of these involves some factors that may be interesting and suggesting to vendors of coke in the United States. Within the past few years quite a number of ingenious devices have been invented and put on the market in this country for the purpose of utilizing coke. The American cooking and house heating apparatus as well are fast becoming adapted to using coke, wherefore the marketing of coke in many cities and towns in the United States has become quite important in scope and profits. Many of the large gas companies consider the coke department sufficiently important to cause the employment of experienced men to handle the product. Some of the companies advertise the coke supply freely in the local press, and no doubt in time the advertising will extend to the trade journals, so that large manufacturing concerns and proprietors of large buildings may bid for it.

In this article is offered some suggestions about the coke business, as gathered by the writer in a coke and charcoal burning country, where the goods are bought chiefly on the day-to-day plan.

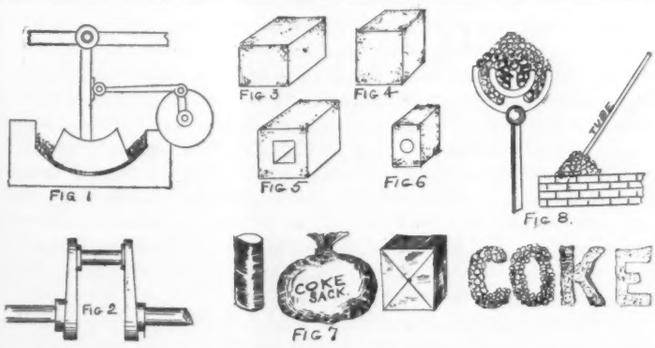
Coke and charcoal manufacturers and dealers are to be found in every town in Cuba. These people employ a number of wagons, the drivers of which go out every morning to peddle coke and charcoal to customers.

The patrons demand coke and charcoal prepared in special ways. When pulverized coke is demanded, the grinding is accomplished with a contrivance fitted with a swinging hammer as shown in Fig. 1. Crushing rolls are also used in some plants. Fig. 1 illustrates a machine that consists of a lever supporting a hardwood block which swings on a stud; the crank for giving the necessary movement is shown in Fig. 2. Steam, wind, water, mule or ox power, with even man power, is used in giving the required motion to the wheel which carries the crank arm. It takes a number of hours for the swinging hammer to properly pulverize the coke.

Some customers use coke in brick or block form, and some odd devices are used for moulding the stuff into the shapes shown in Figs. 3, 4, 5 and 6. In one plant several cement-block making machines were utilized for the squeezing of the pulverized coke into briquettes. Then some of the cubes are hollow, with bores through the middle, caused by using spindles in the moulds.

Fig. 7 shows another system of delivery. Here hollow bamboo tubes are used, cut to convenient size. These tubes are packed with the ground coke and sealed. Then the tubes are sold outright. The consumer puts the entire tube into the fire. Considerable ground coke is sold in 10-pound sacks. The Cuban coke sack is made of burlap or paper; the burlap is not new, but is purchased from the bakeries—the bakeries sell the empty burlap flour sacks at low prices. The ground coke is also put up in square paper packages. Strong paper is used and the coke is moistened just enough so that a cube can be moulded readily and supported while the pack is being made secure.

The coke people in Cuba have odd ways of advertising their goods. I saw one party going ahead of the coke wagon with coke ignited in a metal, prong-shaped carrier, as illustrated in Fig. 8. The burning



coke did not seem to attract much notice, but evidently the intention was to prove that the coke would burn well. They also advertise their goods by showing the artisans of the country how to use the coke in metal working, on firebrick stands, with a blow tube, as in Fig. 8. The strong winded salesman can demonstrate that an intense heat can be derived from the coke fire when the blow tube is used. I also observed a coke sign, made with pieces of coke cemented in letter form to a board base. There is without a doubt a rich field opening throughout America for coke for many purposes, if coke can be put up in neat, marketable packages to sell at low prices and convenient for the housekeeper and the man at the forge. I imagine that the Consolidated Gas Company, of your city, is going the right way about this. The initial expense may seem heavy, but persistence is sure to be rewarded. In coke fuel the housekeeper gets the goods.

People like gasoline and alcohol because there is no refuse. The up-to-date packages of coke which I have seen in this and other countries of late, are used without refuse. The sack, the cardboard or paper exterior, and all, are consumed with the coke.

[Continued from page 781.]

PROCEEDINGS, FIFTH ANNUAL MEETING, ILLINOIS GAS ASSOCIATION.

HELD IN CHICAGO, ILLS., MARCH 17TH AND 18TH, 1909.

FIRST DAY—AFTERNOON SESSION.

The President having called the meeting to order at the time appointed, announced that Mr. J. B. Howard's carnations, as he told them this morning, were given to adorn the speakers table, and which had been given to him the evening before as a token representing his 79 years of service in the gas industry. As an Honorary Member of the Association, he had consented to give them a short "talk" on

PERSONAL REMINISCENCES.

Mr. Howard spoke as follows:

In the city of New York, in 1846, the gasfitting was done mostly by the gas company, and copper pipe with brass fittings was largely used. The old Astor House was partly fitted up with copper pipes, and in 1846 I assisted in taking out a large amount of copper pipe from the hotel, replacing it with iron pipe. The next year the copper pipe remaining was entirely replaced with iron pipe.

There were quite a large number of accidental explosions by blowing through old copper pipes. Two persons, employees of the gas company, were fatally injured. The stocks and dies, in use at that time, were the flat dies, or like those used for threading bolts, except that the die cut gas pipe threads. Many a crooked thread was cut, and in order to make these straight, especially on large pipes, the pipes were screwed together, heated and straightened. In cutting off we used a 14-inch, flat, bastard file, and on the larger pipes we used a chisel. Brass fittings were mostly used, and an Englishman in Brooklyn, N. Y., did quite a business in making wrought iron fittings which were quite neat in appearance and well made. One day,

in looking at his work, he made a ½ inch, 6-way piece, merely to show what he could do in that line.

I had fitted up quite a number of houses not using any fittings. For the off-takes and for bends and drops, instead of employing elbows, tees or other fittings, we used to dovetail a brass socket into the iron pipe and braze the joint with hard solder. All work was put together and proved in the shop before taken to the job. The iron pipe used was mostly of foreign make and defective in splits.

In 1856 I went West, and in a short time became connected with the gas company at Dubuque, Ia. We were then using cast iron retorts in benches of 3's to the setting. We had to be careful to protect retorts from passing fumes and to avoid high heats that might melt them. The mouthpieces were joined to retort before placing in bench. The retorts lasted about 2 years. Prior to the war, iron retorts could be bought for $25 each, and during the war the price went up to $125 each. We paid as high as $8.25 to $11.25 a short ton for Pittsburgh coal, and raised the price of gas to $3.50 per 1,000 without ever asking consent of the City Council, and no kicking on gas bills. Greenbacks were plentiful.

In March, 1859, we ran short of coal. The ice in the Mississippi river was about breaking up and the ferryboat could not run. We had plenty of coal on the other side, but there was no coal in the city. I had some correspondence with Prof. Cresson, of Philadelphia, the patentee of a process of making wood gas, which gave me some information. I bought several cords of dry wood, and for 5 days turned out wood gas. We were using Rock Island coal prior to that, so there was very little difference in the illuminating power; not enough to be noticed by the consumers. We fortunately had plenty of coke on hand, which enabled us to keep up the heat in benches. Our purifying boxes were 4 feet by 4 feet, with wet centerseal surface or air condensers, consisting of twelve 6-inch cast iron pipes, 14 feet high. The large amount of sulphur contained in Rock Island coal, which we were using, kept us quite busy changing purifiers.

I had quite an experience with a new purifying house nearly 40 years ago. We put in an 8-inch dry centerseal, the one made up to that time, by a concern at present one of the largest and most successful manufacturers of gas machinery in the United States. I happened to look at the cover of seal just before it was to be put in place, and found one of the openings closed by a thin film of casting; the core being too short, left the opening closed. I called the attention of the man sent out to put up the work to it and asked him if he had examined the cover. He replied he had, and it was all right, and when I told him what I discovered, he said it could not be so as Mr. —— would never turn out a piece of work like that, unfinished. After taking him and the cover to the machine shop to have the casting drilled out, I satisfied him that he was mistaken. You can imagine the trouble it would have given me had I not noticed the defect before gas was made in the new plant. In setting 2 benches of 3's, clay retorts, we used the plan of setting made by Paul A. Sabbaton, of Albany, N. Y., and I believe they were the first clay retorts put in west of the Mississippi river. The St. Louis gas works were then using cast iron retorts. That was in the year 1859. Mr. Sabbaton was considered the "Daddy" of clay retorts at that time. His instructions in placing retorts in benches were to have 8 men, with wooden skids; it left the back end of retort to rest on the tile, then lift the retort and shove it into place. The retorts, tile, firebricks and clay were imported from Belgium, no clay retorts being manufactured in this country at that time. The high heats of the city retorts in comparison with those of iron retorts were a surprise to the firemen, who often said: "Mr. Howard; sure, you will melt the bench."

We had been running the 2 benches of 3 clay retorts about 3 months when, about 6 P.M. one day, the first week of June, there came a tremendous rain fall. The streets could not carry off the water, which commenced flowing in the retort house until it rose about 6 inches above the bottom of the lower retorts. Seeing what was coming, we took out the stoppers in front of benches to give vent to the steam arising from the heated water in benches. In about 3 hours after the rain ceased we had the water cleared from retort house and commenced firing up the benches, and the following morning commenced to charge and make gas. Strange to say no damage was done to any of the retorts.

Our experience with a steam jet exhauster proves how important it is for the superintendent to know every morning, especially at small works, that everything is working right. One morning, after a few days running of the new steam-jet exhauster, I was testing with one of the American Meter Company's improved jet photometers, the illuminating power of the gas we were making, and the hand on dial moved around to figure 11. I then lit a burner in the office and it showed a blue flame. I went in the retort to find what the trouble was, and asked the fireman if there was anything going wrong. He said: "We don't know, but every time we take off to make a charge there is a noise like 'ahoo, ahoo.'" I immediately went to look at the gauges on exhauster and found one showing 1½-inch vacuum, caused by moving of right and-left ball screw on rod, regulating the steam supply to exhauster, and this in turn due to the vibration of rod, thereby turning on more steam than the quantity of gas then required. I had two sheets of blue gas in the holder, and thinking that rosin would be the most speedy in bringing up the illuminating power, I procured several barrels, had it broken up and made wooden boxes that would go in retorts, filling same with rosin and covering it over with about 3 inches of coke breeze to prevent the rosin from lighting until we could get lid on mouthpiece. By lighting time, we had about 13 candle gas, but getting better right along. I mention this to show how important it is to have a daily lookout over the works.

In building a 60-foot holder, I had an experience perhaps worth mentioning. In digging out the pit for the brickwork, the soil for about 10 feet was about the same kind, and from that to the depth of 22 feet was partly clay and sand. We made an extra width and depth of concrete to sustain brickwork and, upon completion of same, and holder built, water was let in. When the tank was full there was a split in the brickwork from top to bottom, caused no doubt by the differences in soil. We threw in the water opposite the crack some horse manure and bran, which stopped the leak somewhat, then dug down and timbered up with 2-inch plank, using a miner's windlass and tub to remove the earth. As we went down we drove wooden plugs in brickwork to keep the water from leaking out until we got to the bottom. We then built up a solid pier opposite the crack. The pit still leaked in other places, but with four applications of spent lime from the purifiers it became tight. The lime was made into mush and poured around the tank. Forcing a stream of water from a ¾ opening around the bottom of pit made this lime circulate and, passing into the small crevices causing the leakage, the lime finally closed up those crevices and the tank remained water tight thereafter. Anticipating the tank would leak—there being no water works in the city—I had a well dug, 30 feet deep and 3 feet in diameter, giving me 6 feet of water to supply the tank. I then put in service a steam pump, 3½-inch water cylinder, and 5½ steam, and in a few hours the well gave out. I then made two 1¼-inch drive well points, 3 feet long, and drove them down inside of the well, one 25 feet and the other 30 feet below the bottom of the well and connected same with the steam pump, and I had an inexhaustible supply of water throwing a full 1¼-inch stream.

In 1859 the meters we had in use being mostly wet, gave us considerable trouble, especially in the winter season. In setting meters we generally placed them where they would not be likely to freeze, and those that could not be so placed in the winter season we filled with whiskey, which at that time could be bought from 18 to 20 cents per gallon. In extreme weather the thermometer showing from 25° to 40° below zero, some of the meters that had not been filled with whiskey would freeze and have to be thawed out. Warm water was not always handy, so we would place the meter alongside of a stove and await the melting, sometimes taking an hour or more before we could give the consumer light. Whiskey increasing in price, we substituted chloride of calcium made into a solution, but gave it up on account of a tendency to corrode owing to the mixing of air, and in a short time the wet meter gave place to the dry one.

Information concerning gas works in the early days or gas lighting in this country was not easily obtainable, unless you were connected with some of the officers of the company. The engineers and superintendents were mostly foreigners, principally Englishmen. When the Burlington (Ia.) gas works were built in 1885, one of the men helping to erect the works asked the superintendent if he could examine the wet centerseal before it was put in place, and was told: "He could not show that, it was a secret in the business." Matters have changed since then. Information to be desired at the present time upon any subject pertaining to gas works, by those engaged in the business, by application to the many eminent gas engineers and superintendents, is freely given and they consider it a pleasure to give whatever information is asked of them.

In the winter of 1861, I had a dignified old gentleman, elegantly dressed, wearing a silk hat, call on me at the gas works. He stated

he wanted to sell the company a preparation for the mixture with lime for purifying that would make a saving from 15 to 20 per cent. He said it was accidentally discovered by some material being spilt on a load of lime in bringing same to the gas works. It was noticed in the use of this particular load that the purifier lasted so much longer. An investigation was made and the name of the material discovered, also, that it would stop the sputtering of the gas while consuming. That last remark made me think it was a fake and, after a little more talk, I felt convinced of my suspicions and finally told him I believed him to be a fraud. He immediately got on his ear and said he would inform the President of the Company, at once, how he had been insulted. I told him I would drive him up to the President and introduce him. He said: "No; I want no more of your company." He left, but never came back. I learned afterwards he had made a few sales, but was finally exposed in the AMERICAN GAS LIGHT JOURNAL. The material to be used with the lime was ground linseed oil cake, mixing 2 quarts to 1 barrel of lime; lime being in universal use at that time. It is the only instance I ever knew of an attempt to swindle a gas company in the manufacturing department.

Col. Pratt—Mr. President, I take great pleasure in moving a vote of thanks to Mr. Howard for his interesting reminiscences. I do not know how the gentlemen here feel, but I imagine they all feel as I do, that such a talk, to men in this day and age, is refreshing, in that we realize at all times that although we have with us a man of the old school, he is nevertheless a man who continues with us, manifestly keeping up with the times; one whom we seldom fail to see at these meetings if he is able to come. We never forget him whether he is or is not here. I count it a great privilege in my life's experience that I have become so well acquainted with "Uncle Jerry" Howard. I move a vote of thanks. [Seconded by Mr. J. T. Lynn, and adopted by rising vote.]

COMMITTEE ON NOMINATIONS.

The President appointed the following Committee on Nominations: Messrs. George F. Goodnow, Chairman; J. H. Eustace and Z. T. F. Runner, who were instructed to report at the morning session.

MR. LYNN EXTENDS AN INVITATION.

Mr. J. T. Lynn here made the following announcement:

Mr. President, Gentlemen of the Illinois Gas Association: I have the honor this year of being President of the Michigan Gas Association, and we contemplate holding our meeting on board one of the Detroit and Cleveland steamers. We expect to leave Detroit September 15th, to take a 3 or 4 days' sail on the Great Lakes, going to Mackinac and the Sault, and while at the Sault visiting the large water powers there and the wonderful electrical development. I wish to personally extend, on behalf of the Michigan Association, to the members of the Illinois Association, an invitation to join us on that trip.

The President—You have heard Mr. Lynn's speech. I am sure nothing could be better than that the various State Associations should know each other better, to become better acquainted with each other, and, without calling for a vote, which I know would be unanimous, I will, on behalf of the Association, thank Mr. Lynn for his courteous invitation and order it spread upon our records. I understand from Mr. Lynn that a formal invitation will be sent out later, which will again remind you of this kind and pleasant suggestion. Our next paper is

AN INVESTIGATION OF THE EFFECTS OF COMPRESSION AND TRANSMISSION ON THE CANDLE POWER AND HEAT UNITS OF MANUFACTURED GAS.

This paper is in two parts, the work on which has been conducted independently. The first is by Mr. H. E. Bates and Mr. J. R. Rafferty, of Chicago. This part of the paper will be read by Mr. Rafferty.

PART I.—READ BY MR. RAFFERTY.

The importance to the gas engineer of the effect of compression on the illuminating power and heating value of illuminating gas, together with the present lack of useful knowledge on this subject, has caused the expression of much regret that more initiative has not been shown by those most vitally interested in the question. It was with the idea of correcting erroneous opinions, and clarifying hazy notions that have doubtless been formed on the subject, that these experiments were undertaken. While it is not within our province to state that no experiments of this kind have been made upon carburetted water gas, we may at least say that, if tangible data of this nature have been published we have been unable to find them. Until the behavior of gas under compression is more thoroughly understood, high pressure systems cannot be advantageously and scientifically manipulated. A clear conception of the reasons for obtaining a drop in candle power of illuminating gas, when compressed, can be best brought about by bearing in mind the following considerations:

All liquids tend to go into the gaseous state, and the measure of this tendency is what is termed vapor tension. This tendency is exhibited in a different degree by different liquids. Water, if left in an open vessel, evaporates at temperatures below its boiling point. Most liquids and some solids act in a similar manner, although the rate at which they do so varies considerably. For instance, alcohol, under the same conditions, evaporates more rapidly, and ether still more rapidly. Mercury, on the other hand, scarcely evaporates at all at ordinary temperatures. For a given liquid there corresponds to each temperature a certain definite pressure of its vapor, at which the two will remain in contact unchanged. At that pressure and temperature none of the liquid will pass into vapor, nor will any of the vapor condense to form liquid. The gas pressure of the vapor balances the vapor tension of the liquid, and this gas pressure is the vapor pressure of the liquid at that temperature, and the vapor itself is saturated. For all liquids the vapor pressure increases with rise of temperature and, consequently, all liquids evaporate more readily as the temperature is raised. When the vapor tension of the liquid just exceeds the atmospheric pressure, the liquid passes freely into vapor and boils.

If we heat a liquid in a closed space, the pressure within the space rises, owing to the increase of the vapor pressure of the liquid, and the properties of the liquid and its saturated vapor gradually approximate each other until, when the critical temperature is reached, the liquid and the vapor become identical, and all distinction between them disappears. The pressure then registered is the critical pressure of the substance.

The temperature below which the substance can be condensed into a liquid, and above which it undergoes compression without liquefaction, is called the critical temperature of the substance, and the pressure which at the critical temperature just suffices to condense the gas to the liquid form is called the critical pressure.

The following table contains the critical temperature and critical pressure of hydrogen, nitrogen, carbon monoxide, oxygen and methane, called the permanent gases, and carbon dioxide:

	Critical Temperature. Degrees F.	Critical Pressure. Atmospheres.
Hydrogen	— 390	20
Nitrogen	— 231	35
Carbon monoxide	— 222	36
Oxygen	— 180	50
Methane	— 140	50
Carbon dioxide	+ 90	77

From the figures given in this table it is evident that, working under the conditions of a temperature of 70° F., and a pressure of from 0 to 100 pounds, no attention need be given to these gases in so far as the problems met with in our work are concerned.

The only constituents of illuminating gas which were probably effected by the pressure used in our tests were the "illuminants." The reason for this may be emphasized by drawing the distinction between a gas and a vapor. A gas at ordinary temperatures, exists as such above its critical temperature. A vapor at ordinary temperatures, exists as such below its critical temperature. A gas must be cooled down to its critical temperature before any pressure whatever can liquefy it. A vhpor may be liquefied without preliminary cooling, by pressure alone, because it already exists below its critical temperature. So, with precision in mind, we might state that the term "hydrocarbon vapors" as indiscriminately applied to the illuminants, is not technically correct. For, by referring to the critical temperature of the first three members of the paraffine series—methane, ethane and propane—and the first member of the olefine series—ethylene—we find that they do not exist as vapors, but as gases, at ordinary temperatures.

An effort was made, by means of some experiments, to find out the composite formula for the illuminants of curburetted water gas. The results would indicate that this composite formula is not the same for different makes of gas. The only statement that could be ventured, with any hope of substantiation, is that the illuminants belong largely to the olefines. It has been a matter of speculation as to whether or not any benzene is present in carburetted water gas. An alleged absorbent for benzene was tried in the Morehead burette.

This absorbent is an ammoniacal solution of nickel cyanide. No

appreciable amount of benzene could be detected by means of this solution. The constitution of the illuminants depends on the oil used and the heat to which it has been subjected. Oils containing larger amounts of members of the paraffine and olefine series and smaller amounts of the higher series, such as the benzene and naphthaline series, are lighter and less complex and demand less heat to decompose them. The heavier and more complex members of the paraffine and olefine series are broken down by the heat into simpler members of the same series, resulting in the final formation of ethylene and propylene, which are the principal constituents of the illuminants. It is probably similar to the manufacture of coal gas when at low temperatures, the products doubtless consisting of the higher members of the paraffine and olefine series, such as butane, pentane, hexane, propylene and butylene, which break down into simpler members of their series.

Having determined, in a broad sort of way, the probable composition which the illuminants approach, let us consider what factors affect them, so far as our tests are concerned. We will first consider pressure. Vapor tension, gas and vapor have been defined, and it is now necessary to state Dalton's Laws which govern a mixture of a gas and a vapor.

(1) The pressure exerted by, and the quantity of a vapor which saturates a given space, are the same for the same temperature, whether the space is filled by a gas or is a vacuum.

(2) The pressure exerted by a mixture of a gas and a vapor, or of two gases, is equal to the sum of the pressures which each would exert if it occupied the same space alone.

In verification of the first Law, if a few drops of water are introduced into a barometer tube in which the mercury stands at 30 inches and the temperature is 59° F., the mercury in the tube will be depressed by the water vapor formed, to the extent of 0.5 inch. Now, if we allow the water to evaporate into a space filled with air or coal gas, or any gas, instead of into a vacuum, the same thing happens, although it takes a longer time. In explanation of the second Law, let us consider water and benzene for a moment.

The pressure of the vapors contained in a gas that has been saturated by these two liquids which are not miscible, is the sum of the vapor pressure of benzene and of water at the temperature at which the gas was saturated. A mixture of 50 per cent. of benzene with 50 per cent. of water, having a vapor pressure at 50° F. of 1.76 inches and 0.36 inch, respectively, gives the mixture a pressure of 2.14 ins.

In the case of liquids miscible in all proportions, such as benzene and toluene, the pressure of the vapors in this mixture is about the mean of the vapor pressures of these liquids. A mixture of 50 per cent. benzene and 50 per cent. toluene, having a vapor pressure at 50° F. of 1.78 inches and 0.41 inch, respectively, had a vapor pressure of 1.16 inches for the mixture at that temperature. Similarly, with two liquids that partially dissolve each other, the tension of the mixture is less than the sum of the tensions. From these laws it is evident that a gas may be saturated with a vapor without its capacity for taking up the vapors of liquids which do not dissolve each other, or the liquid of the first vapor, being impaired. If the liquids are soluble in each other, however, saturation of a gas with their vapors reduces its capacity for carrying vapors with higher tensions, since the increase in tension, due to the addition of the new vapor, is not as high as the tension of the last vapor if it existed alone. A gas saturated with a mixture of vapors of low tension may be enriched on the addition of high tension vapor, while a gas saturated with vapors of higher tensions will have its mean vapor tension decreased on the addition of vapors of lower tension.

Let us consider a practical case. Suppose we have carburetted water gas saturated with hydrocarbon vapors, and we wish to enrich it by benzene, the latter being used because of its high vapor tension and its ability to withstand low temperatures. If the tension of the vapors in the gas is the same as the tension of the benzene vapor, no enrichment will occur, because the tension of the vapor necessary to saturate the gas at the given temperature is already present. If the vapor tension of the benzene is higher than that of the hydrocarbons in the gas, enrichment will occur. On the contrary, if the vapor tension of the benzene is below that of the hydrocarbons in the gas, an actual loss in candle power may result. Besides the effect of pressure in condensing the hydrocarbon vapors, and the effect of temperature on the vapor tension of the same, we might mention the deleterious effect of scrubbing and baffling which the mains afford in taking out illuminants. But little of this was met with in our work, and would more fittingly be discussed in transmission tests.

Most of the physical laws which afford a solution of the problems met with in our tests have been discussed and will be applied in studying these tests.

For making the tests the apparatus was arranged as shown in Fig. 1. A 3-horse power vertical engine ran a compressor by means

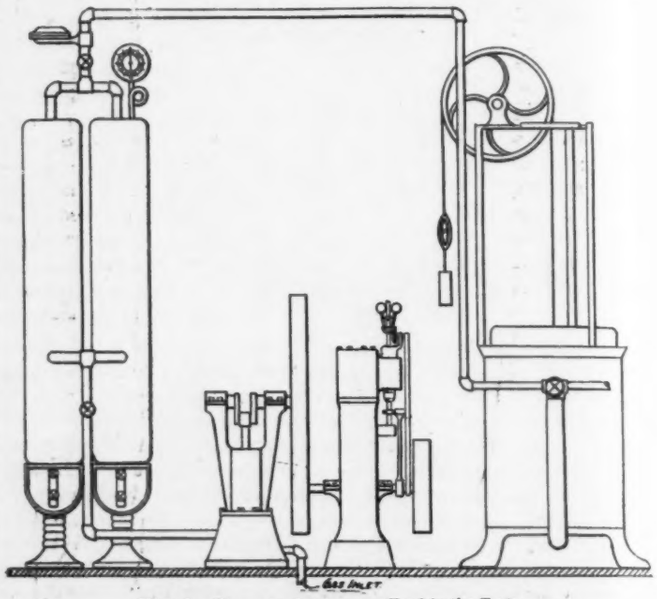


Fig. 1.—Diagram of Apparatus Used in the Tests.

of a belt. The compressor was connected, by a short length of pipe, to two 30-gallon, galvanized iron tanks, in which the gas was compressed. The tanks were so connected that the pressure in each was the same at all times and was indicated by a pressure gauge. A thermometer on the tanks showed the temperature of the compressed gas, and cocks on the bottom of each tank provided means of removing any condensation that might be formed.

A Williamson high pressure governor, on the outlet from the tanks, regulated the pressure of the gas, and the latter was further regulated by passing it into a meter prover. The outlet to the meter prover was connected by two branch pipes to a Junkers calorimeter and to a 110-inch bar photometer. The branch pipe to the calorimeter was also connected to a Morehead burette, so that a gas analysis could be made. The gas used in all the tests was carburetted water gas, and all tests were conducted in the following manner:

The candle power and heating value of the normal gas were taken, and then the gas was compressed to the desired pressure, the inlet valve closed and the gas allowed to stand for about an hour, until it had cooled down to the room temperature. After standing for an hour, whatever condensation may have been formed was removed, and then the compressed gas passed through the Williamson governor and into the meter prover. From the meter prover the gas passed at constant pressure into the branch pipes leading to the photometer and calorimeter.

Tests were made at three different pressures each day, and, as the normal gas during any one day was fairly constant, one complete analysis each day was made and the carbon dioxide and illuminants determined in the gas after each compression. After testing the gas at any one pressure, and before compressing to a different pressure, the outlet and inlet valves were opened and gas pumped through the system. This purged the tanks and pipes of all gas and condensation which may have been left from the previous test, and thus prevented the new gas compressed from taking up any of the condensation, which would nullify the test. The piping was so arranged that the gas entered the storage tanks near the bottom and was drawn out at the top. By this arrangement whatever condensation deposited, due to the compression of the gas, settled on the bottom and could be withdrawn. This prevented the gas mechanically taking up the condensation again when the pressure was released.

Simultaneous readings of candle power and heat value of the gas were taken. A No. 7 Bray burner of the slit union type was used, burning gas at the rate of 5 cubic feet per hour. It was intended to remove the condensation and then obtain its vapor tension, but on subsequent removal of the condensation, the amount obtained was only a trace, which was too small to make any determinations. This was contrary to what we had expected, but the small amount obtained

was due, no doubt, to the small size of the containing tanks, each one holding 6½ cubic feet of gas.

Gas of different candle powers was tested: One of 21, one of 22 and one of 24-candle power. The reason for taking such a course was to affirm or refute the idea, held by many experienced gas men, that the higher the candle power of the gas the larger the drop in candle power on compression. The following table gives the candle power and heat value drop for the different candle power gases.

TABLE I.

21-Candle Power.			22-Candle Power.			24-Candle Power.		
Pressure Lbs. per Sq. Inch.	C. P. Drop.	B.T.U. Drop.	Pressure Lbs. per Sq. Inch.	C. P. Drop.	B.T.U. Drop.	Pressure Lbs. per Sq. Inch.	C. P. Drop.	B.T.U. Drop.
5	0.58	*7	5	0.40	5	5	0.79	19
10	0.93	6	10	0.90	7	10	1.20	15
15	1.44	4	25	2.10	16	25	1.70	22
20	2.04	14	55	3.30	19	35	1.76	6
30	2.40	16	80	3.45	19	50	2.50	16
40	2.80	20	85	3.50	16	60	2.49	20
45	2.81	8	100	3.28	27	65	2.81	11
70	2.95	15	..	...	..	80	3.02	32
75	3.30	12	..	...	..	90	3.23	37
100	3.25	17	..	...	..	.	...	..

* In this one instance, we obtain d an increase in B.T.U. when the gas was compressed.

The figures given in Table II. indicate the candle power and B.T.U. drop in per cent.

TABLE II.

21-Candle Power Gas.			22-Candle Power Gas.			24-Candle Power Gas.		
Pressure Lbs. per Sq. Inch.	Pr. Ct. Drop in C. P.	Pr. Ct. Drop in B.T.U.	Pressure Lbs. per Sq. Inch.	Pr. Ct. Drop in C. P.	Pr. Ct. Drop in B.T.U.	Pressure Lbs. per Sq. Inch.	Pr. Ct. Drop in C. P	Pr. Ct. Drop in B.T.U.
5	2.70	*1.06	5	1.80	0.73	5	3.30	2.63
10	4.43	0.89	10	4.05	1.01	10	5.11	2.14
15	6.86	0.59	25	9.62	2.35	25	7.06	3.08
20	9.50	2.09	55	14.90	2.80	35	7.43	0.85
30	11.23	2.34	80	15.60	2.81	50	10.60	2.28
40	13.30	3.05	85	15.60	3.31	60	10.50	2.82
45	13.50	1.19	100	15.24	3.92	65	11.70	1.54
70	14.10	2.25	..	....	...	80	12.57	4.42
75	15.60	1.77	..	....	...	90	13.63	5.20
100	15.50	2.53	..	.....	...	..	....	...

* Increase.

Figs. 2 and 3 are curves plotted from the data given in the foregoing Tables I. and II. respectively. Fig. 4 shows what candle power we may expect to obtain on compressing a 21, 22 or 24-candle power gas to any pressure between 0 and 100 pounds. Similarly, Fig. 5 gives the value in per cent. of any one of the three candle power gases which we may expect to obtain on compression. For instance, if we compress a 21-candle power gas to 90 pounds, by referring to Fig. 4, we trace the vertical line leading from the 90-pound pressure point to the 21-candle power curve, and then follow this to the left, getting a result of 17.7-candle power after compression. The same mode of procedure follows for the curves in Fig. 5.

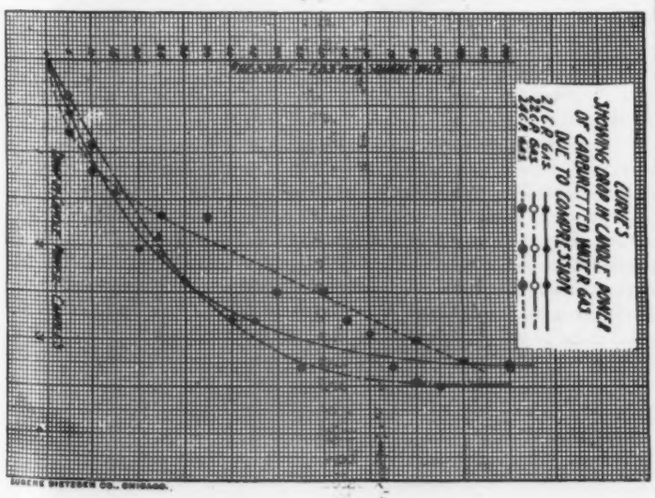


Fig. 2.

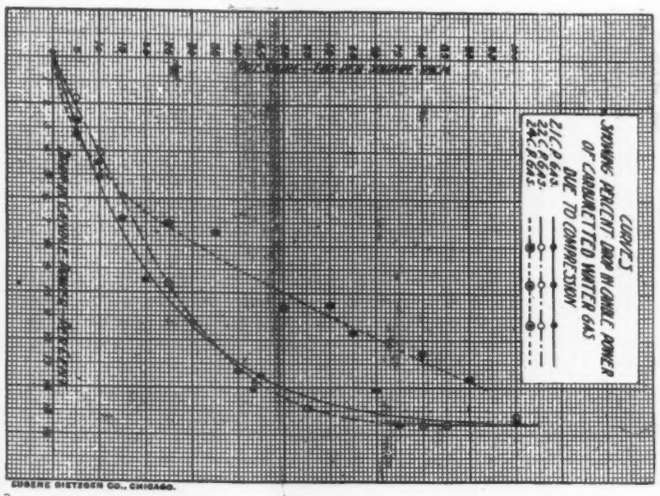


Fig. 3.

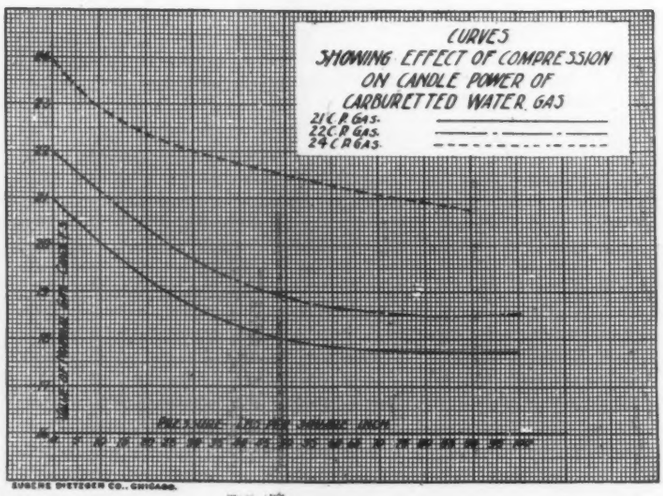


Fig. 4.

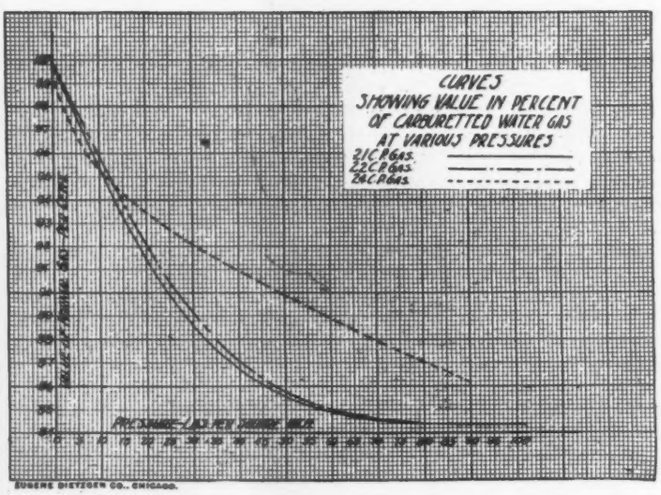


Fig. 5.

We may now investigate the reasons for obtaining a drop in candle power on compression. Looking at the condensation from the standpoint of critical pressure and critical temperature, it contains mainly those hydrocarbons which have a critical temperature above 70° F. If we had ethylene alone in the illuminants, we would not get any condensation from compression, because its critical temperature is 48.2° F. and we compressed at 70° F. A vapor can be condensed at a pressure less than its critical pressure, because it already exists at a

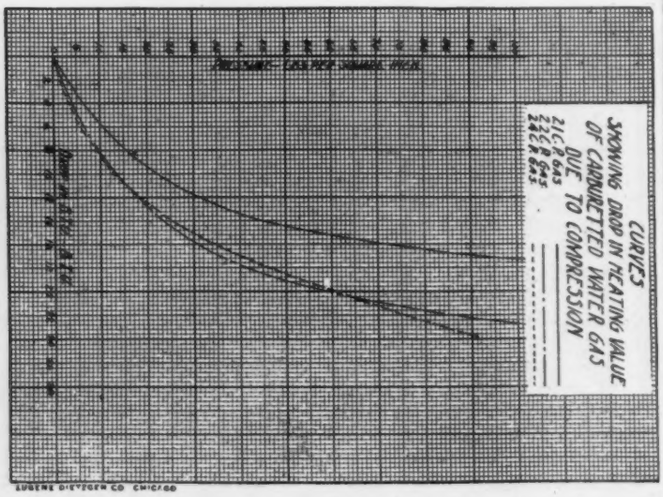


Fig. 6.

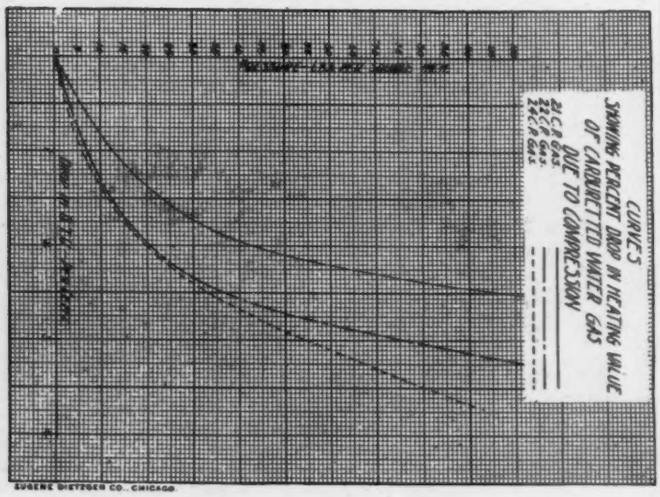


Fig. 7.

point below its critical temperature. In other words, liquefaction of the vapor occurs at any temperature when the pressure put upon it exceeds the pressure of the vapor at that temperature. Taking the illuminants as a whole, we have the individual vapor pressures, critical temperatures, and critical pressures of all the separate constituents, giving up an average vapor pressure, critical temperature, and critical pressure for the mixture. Perhaps it would be well to give a tabular description of the manner in which the other constituents of carburetted water gas enter into our problem. For convenience, take 100 cubic feet of gas under 10 pounds pressure, with the composition, each in per cents: $CO_2 = 3$; $O_2 = 1$; $H_2 = 30$; $N_2 = 50$; Ill. = 12

Assume the illuminants are vapors and that they saturate the gas.

100 *Cubic Feet of Gas Under* 10 *Pounds Pressure.*

Constituents.	CO_2.	Ill.	O_2.	CO.	H_2.	CH_4.	N_2.
Actual volume in cubic feet...	3	12	1	30	30	19	5
Partial pressure of each constituent in lbs.....	0.3	1.2	0.1	3	3	1.9	0.5

We see that, in order for the gas to counterbalance the 10 pounds pressure with which it is in equilibrium, each constituent contributes a partial pressure proportional to its volume. We may say that the mean vapor pressure of all the illuminants equals 1.2 pounds. We will now double the pressure and before condensation of any hydrocarbon vapors take place we have the following conditions.

50 *Cubic feet of Gas Under* 20 *Pounds Pressure.*

Constituents.	CO_2.	Ill.	O_2.	CO.	H_2.	CH_4.	N_2.
Actual volume in cubic feet....	1.5	6.0	0.5	15	15	9.5	2.5
Partial pressure of each constituent in lbs	0.6	2.4	0.2	6	6	3.8	1.07

For simplicity let us assume that the vapor pressure of the illuminants remains constant. Under the conditions of 10 lbs. pressure the partial pressure of the illuminants equaled their vapor pressure. When we compressed to 20 lbs. we momentarily doubled the density of the illuminants, thereby doubling its partial pressure. Bearing in mind that we assumed constant vapor pressure for the illuminants, we then have their partial pressure greater than their vapor pressure and condensation ensues. Condensation continues until the partial pressure equals the vapor pressure. Therefore, as long as the partial pressure of a vapor is greater than its vapor pressure, the vapor will condense. When the partial pressure of the vapor equals its vapor pressure, then a state of equilibrium is obtained.

If we had assumed that the illuminants did not initially saturate the gas, or, in other words, if their partial pressure were less than vapor pressure, they might undergo some compression without condensation. In our case, the fact that the partial pressure of the illuminants must be 1.2, necessarily leaves 1.2 lbs. to be divided up among the other constituents. This increase in partial pressure which the latter assume decreases their volume. The following table shows this.

47.16 *Cubic Feet of Gas Under* 20 *Pounds Pressure.*

Constituents.	CO_2.	Ill.	O_2.	CO.	H_2.	CH_4.	N_2.
Actual volume in cubic feet..	1.405	6.0	.468	14.05	14.05	8.896	2.341
Partial pressure of each constituent in lbs	.64	1.2	.21	6.41	6.41	4.06	1.07

In our tests all the constituents, except the illuminants, obey Boyle's law on doubling the pressure. In other words, the volume varies inversely as the pressure. Each of these gases was, therefore, decreased in volume by one-half. The illuminants assumed to be vapors, and assumed to be at their maximum density for the temperature at which we compressed, condensed. It is wholly hypothetical as to how much hydrocarbon vapor was liquefied. We assumed that 6 cubic feet condensed to simplify our table. At any rate, we must have a partial pressure of 2.4 lbs. in order for them to remain in equilibrium with the part of the 20 lbs. outside pressure which they must sustain. Provided that we were dealing with water vapor alone, if the 20 pounds pressure was sufficient to liquefy part of the latter, it seems reasonable that, since the outside pressure per unit volume increased as the volume of water vapor decreased, finally the 20 lbs. pressure would be sufficient to condense all the vapor to water. It is manifest that, owing to the constant temperature, the pressure of the water vapor would be constant, and any pressure greater than that of the water vapor, of any volume, would remain greater as long as applied, and as long as any water vapor existed.

But we have a different state of affairs in dealing with the illuminants. Whereas with water vapor we were dealing with constant composition, no matter how far the condensation progressed—that is, with H_2O—in the case of illuminants we have a mixture of hydrocarbons of various composition, each having a different vapor pressure, critical temperature and critical pressure, all together giving us averages of these three constants for the mixture. It seems likely that this condensation contains the hydrocarbons having the lowest vapor pressure, and that the more illuminants of low tension we liquefy the higher will be the tension of the remaining mixture of hydrocarbons. In our example the hydrocarbons will condense under the 20 lbs. pressure, until the vapor pressure of the mixture equals 2.4 lbs., when they will be in equilibrium with the outside pressure.

This seems to us to be the simplest explanation of the deteriorating effect illuminating gas undergoes on long standing. The hydrocarbons are under a pressure greater than the vapor pressure of their mixture, and gradually condense out until, by continually dropping out vapors of low tension, the mixture attains a vapor pressure which puts them in equilibrium with the outside pressure.

In some cases our analysis indicated a loss in CO_2 after compression. This acid diminution may be ascribed to its solubility in water, and as the water vapor in the gas condensed when compressed, it took down with it some CO_2. We might state here that this condensing water vapor could probably take down with it any illuminants which might be in mechanical suspension in the gas.

Among the many interesting features of the curves that we have plotted, the one which seems most important shows less drop with 24-candle power gas than with 21-candle power or 22-candle power gas. It is generally believed that most of the illuminants are composed of ethylene; at least they bear its chemical formula when written in equations. Now, let us consider a 24-candle power gas having 12 per cent. of illuminants, and that they contain 10 per cent. of ethylene, 1 per cent. of propylene and 1 per cent. of homologues of the olefine series or more complex hydrocarbons.

In the same light, view a 21-candle power gas which has been made

the same as the 24-candle power gas, as far as practical conditions would allow. In other words, the heat used in breaking up the oils was approximately the same, and the only reason for the difference in candle power was the difference in the amount of oil used.

Figuring on this basis, if we take 10.5 per cent. as the amount of illuminants in the 21-candle power gas, we will get 8.75 per cent. of ethylene and 1.75 per cent. of propylene and other hydrocarbons. Compress these two gases to a certain pressure. We have previously stated that the critical temperature of ethylene is 9° C., which is far below the temperature at which we worked, so that it does not seem probable the pressure used would materially affect it. On the other hand, it seems probable that the drop in candle power which we would get would be due to the condensing of some or all of the 2 per cent. of vapors other than ethylene in the 24-candle power gas, and the 1.75 per cent. of vapors other than ethylene in the 21-candle power gas. The reason for this might be that the critical temperature of these condensed vapors was about 70° F., the temperature at which we worked. It is, therefore, a plausible supposition that, while both the 21-candle power and the 24-candle power gas perhaps lost nearly equal amounts of vapors by condensation, still the excess of ethylene in the 24-candle power gas explains the fact that we got less drop.

The 21 and 22-candle power curves converge at 100 lbs. and seem to indicate that above 100 lbs. little condensation need be looked for. Might this not be due to the fact that all the vapors remaining in the gas at this point have a critical temperature below 70° F. and are immune from the effects of more pressure?

The effect of the excess of ethylene in the 24-candle power gas can be seen by a survey of the curves. It seems very probable that this excess increased the vapor tension over that of the 21 and 22-candle power gas, so that less drop was obtained on compressing high candle power gas than that of lower illumination. On the other hand, the curves indicate a slightly larger drop for high than for low candle power gas at 5 and 10 lbs. pressure. It is widely believed that the high candle power gas contains considerable amounts of hydrocarbons of complex molecular structure. The more complex the molecule, the higher its illuminating qualities and the lower its vapor tension. If the vapor pressure of these heavy hydrocarbon vapors is low, naturally we would expect them to drop out at low pressures. Our analysis of the compressed gas shows but little drop in per cent. of illuminants; not more than .8 per cent. when the highest drop in candle power was obtained. The diminution in per cent. illuminants was not proportional to the drop in candle power, but their small amount warrants our statement that it is probable that the vapors of low tension that drop out on low pressure are of complex structure and of higher illuminating value.

Right here it might be well to mention a few factors which tend to increase the luminosity of the gas:

(1.) The temperature of the gas.
(2.) The density of the gas.
(3.) The presence in the flame of solid matter.

Water gas would probably come under the last of these heads. The decomposition which takes place in the gas flame causes the formation of dense vapors which become incandescent. Solid carbon is also liberated, which increases the luminosity of the flame by its ignition and combustion. A water gas of 21 candle power and a coal gas of 19-candle power, both having the same heating value of 660 B.T.U., were found to contain different amounts of total carbon. The former contained more carbon than the latter. They had the same heating value and yet the candle power was not the same. Part of this difference might be due to the fact that one gas contained more carbon than the other gas. Flames in which no solid matter exists become more luminous on increase of pressure. Finally, gases which give flames of feeble luminosity in low temperatures, become very rich in light-giving properties when the temperature of these gases is increased. In connection with our work, tests were made with the idea in mind of determining an average value for the heating power of the illuminants of water gas. To do this, the CO and illuminants were absorbed from the gas, and the remaining constituents passed into a Junkers calorimeter. Heat values of the gas containing the illuminants were determined. From the results obtained, we may say that the highest heat value obtained for a cubic foot of illuminants was 2,277 B.T.U. Of course, this value depends entirely on the quality of the gas. Whether this is the highest result one is likely to find in ordinary carburetted water gas as it is made to-day, we cannot say, but we can state from experiment that it is not the lowest value by 100 B.T.U.

Table I. shows the variable results obtained in our heat value tests. While the candle power decreased uniformly with the pressure, the B.T.U. did not. The candle power results when plotted gave good curves, but it might be well to say that the B.T.U. curves are only averages and, in our opinion, give a fair idea of the behavior of the heat value of water gas under different pressures. By consulting the heat value results given in Table I., we have a different state of affairs to that which obtained when we considered our candle power data. Whereas the luminosity of the 24-candle power gas experienced less drop than the 21-candle power or the 22-candle power gas, the conditions are reversed in considering the heat values. In other words, the loss in B.T.U. was greatest with the high candle power gas. The variability of these B.T.U. figures must limit the conclusions drawn to a very general character. They indicate that the condensation obtained at the same pressure for the 3-candle power gases is not of the same character. At any rate, the condensate of the 24-candle power gas possesses hydrocarbons which have a lower candle power and higher heat value than those found in the condensate of the 21-candle power gas. If we assume that the 24-candle power gas contains more complex hydrocarbons than the 21-candle power gas—and we have good ground for the assumption—we can imagine why the B.T.U. drop was largest with high candle power gas, for these complex illuminants have a very high heat value and a low vapor tension. They are, therefore, easily condensible and the gas that loses most of them suffers most in B.T.U.

In conclusion, we may summarize the results obtained by compressing carburetted water gas:

1. The candle power of carburetted water gas decreases as the pressure increases from 0 to 100 lbs., temperature remaining constant.
2. The loss in candle power due to compression of gas of high candle power is not as great as that obtained from compressing gas of low candle power.
3. The loss in candle power due to compression of water gas is greater between 5 lbs. and 60 lbs. pressure than between 60 lbs. and 100 lbs. pressure.
4. The heating value of water gas decreases as the pressure increases, from 0 to 100 lbs., temperature remaining constant.
5. The loss of heating value due to the compression of water gas is greater for high candle power gas than for low candle power gas.

(To be Continued.)

Goshen's Gas Works.

Not that Goshen has not had a gas works for many years, since the first plant was constructed there in 1864. But, like all the gas works that was planned and carried out by Mr. B. Van Steenbergh, and his men, it did not stand "the lapse of time." In fact, his constructions—especially those that were put up with a view to exploiting in the real the Van Steenbergh "process"—were of an indeterminate life. Usually that span of existence was under (decidedly under) the average. To begin with, Goshen is the capital seat of one of the most beautiful counties in New York, the county of Orange. It is on the main line of the much panhandled Erie Railroad, and nestles in the picturesque Walkill hills between Newburgh and Port Jervis. Its population, from some cause unknown to many, never was a tithe of what it should have been, possibly because the Erie had it completely at its mercy, partly because the owners of the fertile soil in and about it were satisfied to let it go in meadow product whereon cattle were fed. Indeed another valued county product was the blooded horse, several noted farms in the Orange valley being given over to the breeding of horses, many which subsequently made their mark on the trotting tracks of the world; yes, even to the steppes of Russia.

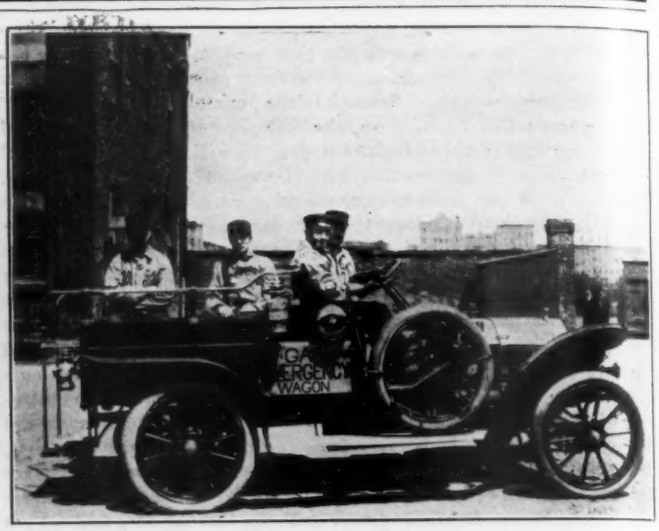
However, all this is beside the main question. The gas works was not a paying proposition for years. Nor was it hard to account for this altogether apart from the matters mentioned above. Poor gas, at a high figure, an unreliable supply, the lack of willingness to accommodate—all these things kept down the increase in the gas business. Several times the plant was sold, at auction and otherwise. But as is often the case commercially, "all's not lost that's in danger," and, right at a time when its fortunes were at the lowest ebb, the perceiving eyes of Mr. John H. Findlay—formerly of Ogdensburg, N. Y., and rather oddly known amongst his intimates by the sobriquet of "Chippie," possibly because he was never known to emit a song that had a modicum of sweet sound to it—about as clever a gas maker and gas seller as the old school ever taught. The works were in bad condition and the property generally was in the custody of the Sheriff;

but that did not daunt Mr. F. Having in due time obtained control no time was wasted in bettering things. and, strange to say, about a year after he took over the plant Goshen commenced to grow and its gain in population, from a percentage point of view, was larger in 1908–09 than at any other period of its history.

Being a thoroughly practical man, Mr. Findlay at once instituted a series of works betterments that really amounted to almost rebuilding, and while these were going on in the plant proper, the main system was also being put somewhat in line to facilitate business extensions. The illustration shows pretty well how the rejuvenated works appeared in the fall of 1908. The center building shown is the retort house, of the dimensions of 37 feet by 32 feet, and 20 feet high, to the wall plates. The house proper is of standard concrete block construction, 12 inches thick. The roof, which is one-quarter pitch, is carried by the end walls and 2 strong trusses, the whole being covered with a slate from Vermont. So, as Mr. Findlay puts it, "We are high-and-dry." The house holds 2 benches of 5's, with wall and room left to place a third. The hydraulic main is provided with hand holes and an adjustable tar seal. The floor is of brick for 4 feet in front of the benches, the balance of front being constructed of heavy concrete. The retort house also has an upright boiler of 75-horse power. The coal shed is attached to and opens into the retort house. It is 32 feet long and 17 feet wide, built of reinforced concrete, with a 10-inch thick concrete floor. At the entrance to the retort house stands a set of Fairbanks scales, at its extreme end is attached a room in which a tar extractor and exhauster are located. The dimension of the room is 16 feet by 12 feet. To the left is the scrubbing and condensing room, which is of brick, 24 feet by 12 feet, and 18 feet high to the wall plates. The condensers and scrubbers are 4 feet by 16 feet 6 inches high, fitted with valves, etc. The tar seal pots are placed in the purifying room, with a view to preventing ammoniacal fumes in the condenser room, which is also used as a workshop. Connected with and in front of said room, is the pipe and fittings shop. This is built of reinforced concrete, and is 22 feet long by 7 feet wide. These are all new buildings that were constructed under the direction of Mr. Findlay. It might be added that still another building (not shown in the cut) was constructed just back of the office, which is devoted to housing the station meter. He is now finishing 2 new purifiers, 6 feet by 6 feet, in addition to an old set of same proportion. The fittings and connections are all 8-inch. The Erie Railway Company were induced to put a switch, leading directly into the coal shed. This all means that Manager Findlay is again actively in harness, and that having put his house in order he will now foster the business to the point where his bank balance will rapidly grow. Through us he wishes to say that any visiting gas man will be welcomed with a will.

Perfecting Its Emergency Department.

The Emergency Department of the Consolidated Gas Company, of New York, was described in an article that appeared in the JOURNAL for April 13th, 1908. This emergency service, probably the most complete maintained by any similar public service corporation, for the convenience and protection of its customers, has kept pace with the demand made upon it, and its already extensive equipment has been augmented by the addition of a 35-horse power automobile, of which an illustration is given herewith. The desirability of substituting motor cars for the horse-drawn vehicles employed in this service is not a question of recent origin, for this has been a matter of discussion for several years past; but the character of the service and the nature of the work which the Department is called upon to perform, rendering prompt and undelayed response of primary importance, precluded the adoption of the motor car until its reliability and practical value for such use could be assured.



The horse-drawn vehicle, though longer in transit and not capable of sustained maximum speed, except for comparatively short distances, was not prone to "tire trouble" or the varied ills that the automobile is popularly supposed to be heir to. On the other hand, the modern motor car, of good construction, when driven by a competent mechanic and maintained in proper state of repair, can no longer be considered unreliable, and for this class of work, where the length of time in transit is such an important factor, it would seem to be particularly well adapted. This saving in time is considerable, especially in the case of long calls; for a uniformly high rate of speed may be maintained throughout the journey, where, with horse-drawn vehicle, the rate of speed was a diminishing one as the distance increased and as the horse became exhausted.

The car illustrated has been in practical operation, carrying the regular crew and equipment, for a long enough period to warrant the belief that the remaining horse-drawn vehicles employed in this service will be replaced by motor cars within a short time.

[OFFICIAL REPORT.—Concluded from Page 785.]

PROCEEDINGS, FIRST ANNUAL MEETING, SOUTHERN GAS ASSOCIATION.

HELD IN THE GRUNEWALD HOTEL, NEW ORLEANS, LA., Feb. 18, 19 and 20.

THIRD DAY—MORNING SESSION.

REMEMBERING THE SECRETARY.

Mr. Congdon—I think as we are all well satisfied with our Secretary, and as I think the Secretary of an Association as prosperous as the one we have (I am sure you felt prosperous on hearing the financial report), is entitled to compensation. The Constitution says the Secretary shall receive such remuneration as shall be decided by a vote of the Association. I move we give the Secretary the large salary of $10 per month for the time being. [Seconded and adopted.]

PRINTING THE PROCEEDINGS.

Mr. Congdon—Quite a number of gentlemen for various reasons could not be with us, have paid their initiation fee of $10 and annual dues of $5, and I think they are entitled to some return from this organization. I believe, not only for this reason, but for the benefit of all, that the Proceedings of this meeting should be put in pamphlet form, and that each member should be given a copy. I, therefore, move that the Secretary arrange to have the Proceedings published in pamphlet form, in the most economical manner he can devise, and that he be instructed to mail a copy to each member.

A FRATERNAL ACT.

Mr. Rushin—A gentleman here with us, a member of this Association, who has been in the business for a long time, travelled a long

way to be at the meeting. I under stand, this morning, that he is now very ill in his room in his hotel. I say to the Association that we should adopt such resolution as would be appropriate, sympathizing with him on account of his illness and wishing him a speedy recovery. I refer to Mr. Mason, of the Welsbach Company. I have known him a long time, and have much respect for him. He is the first man who showed me how to adjust a Welsbach burner. [Seconded and adopted.]

COMMITTEE ON RESOLUTIONS.

The President—I suggest that a Committee on Resolutions be appointed to report on board the boat, for we have not much time now to prepare such resolutions. With your approval I will name as that Committee Messrs. Rushin, Moore and Pullen. They will report on board the boat a short time before we land.

Mr. Frund—On behalf of those who participated in the delightful trip yesterday afternoon, it is desired that our hearty appreciation be extended.

The President—The Committee on Resolutions is supposed to take care of that. Any other resolutions or motions should be made now. When we get through with the election of officers we will have to adjourn and wend our way to the head of Canal street. I now ask for the

REPORT OF COMMITTEE ON NOMINATIONS.

Chairman Dexter submitted the following as office bearers for the ensuing year:

For President—R. C. Congdon, Atlanta, Ga.
For Vice-President—A. W. Frund, Salisbury, N. C.
For Secretary-Treasurer—James Ferrier, Rome, Ga.
For Directors (to serve for the next two years)—J. R. Huntting, Chattanooga; R. M. Redding, New Orleans; J. T. Pullen, Jackson, Miss.; H. M. Moore, Austin, Tex.

ELECTION OF OFFICERS.

The President—You have heard the report of the Committee. Is it your desire that we should immediately proceed to elect the gentlemen nominated? Taking that as your desire, the nomination for President is now before you. Are there any other nominations? If there are none, what is your pleasure? I will entertain a motion to have the Secretary cast the vote of the Association.

[It was moved and seconded that the Secretary cast the ballots of the Association in favor of the gentlemen named. The Secretary subsequently reported that he had carried out the instructions and the President announced the result.]

RESPONSES.

The President introduced President-elect Congdon, who spoke as follows:

I am deeply appreciative of the honor conferred upon me in electing me President of this Association to serve for the ensuing year. I feel the weight of responsibility the position carries with it, and I realize that I am not as fortunate as my friend, Mr. Miller. For, if Mr. Miller had done no work at all, but had simply allowed his name to be used as President of the Southern Gas Association, that name would have carried with it great prestige, which, in fact, it has. Through him the help which this Association has gained in getting a start, on what we hope will be its very long journey, cannot be over-estimated. I will have to make up for my lack of prestige by hard work. Mr. Miller has not only served the Association through the prestige at his command, but has labored in its behalf. I know he is a very busy man. Even now his desk is piled high with papers requiring his attention, and I personally feel deeply appreciative of the services he has rendered. Very frequently newly elected presidents have said they could do very little unless they could have the support of the entire Association; and I believe, too, it is customary to regard the work as resting heavily upon the Secretary. I can promise you that, in the position of President, I will do all I can for the Association, and whereas we must have co-operation, still, I will try to fill all positions, if necessary, in order to make this movement a success. I want you all to feel that you can call on me during the year, and I will give you my best efforts. Again, I wish to express my appreciation of the honor you have conferred upon me, and I thank you.

The President—I would like to announce, so that there will be no mistake, that we are going to the boat, and I want you to bring your friends and ladies and babies. We are not going to have a floating palace, only a good, safe, strong boat, the "Alice," to take us up and down the river to see the harbor, which will be doubly worth seeing on such a beautiful day. The boat leaves the head of Canal street, and will be moored either above or below the ferry house. Be there as near to 1 o'clock as possible, for we want to take a long ride from Chalmette to the water works. There will be pretzels and beer aboard, so don't stop to get your lunch. We can begin eating as soon as we want to, but I suggest that we ride to Chalmette, thus viewing the river going down. We can eat on the journey homeward.

Vice-President Frund—This is indeed an unexpected surprise to me. I trust, when the fiscal year is up, you will not regret having conferred upon me the honor you have conferred. I trust you will be able to do what I did in the Northwest, when I occupied a like position in the Northwestern Gas Association. I request the President not to hesitate to let me do what I can in my humble way for the Association, and I thank you for the favor conferred upon me.

Secretary Ferrier—I am not going to take up any time. I appreciate, gentlemen, the honor conferred and the emolument, which I think is quite sufficient. I will do my best always for the Southern Gas Association.

The Convention thereupon adjourned.

The Calorific Power of London Gas.

The *Journal of Gas Lighting* notes that the acceptance by the Gas Light and Coke Company of a standard calorific power for the gas supplied by them in connection with the Bill now before Parliament, gives additional significance to the results of the "information" testings of calorific power which have been carried out in the gas testing places of the Metropolis for the last 3 years. Some particulars of these results for the first 6 weeks of each year were given in the *Journal* for March 9 (p. 687) on the eve of the settlement of terms between the London County Council and the Company for the acceptance by the latter of a standard calorific power, and of "penalty" testings for the same. Now that the terms agreed upon have become known through the proceedings in Committee of the House of Commons, as reported in last week's *Journal*, it will be appropriate to resume the summary of the results of the testings for previous years at the point at which it was broken off in the article in our issue of the 9th ult.

The figures there given refer to the 6 weeks ending Feb. 8, 1908, and the 6 weeks ending Feb. 6, 1909. The London County Council returns of gas testings for the next subsequent 7 weeks of 1909 are now all to hand, and the following table gives the average for, and the maximum and minimum of, figures obtained during the 7 weeks in question of the 2 years.[1]

TABLE I.—*Testings of Calorific Power (Calories per Cubic Foot).*

	1908—Net.		
	Aver.	Max.	Min.
Gas Light and Coke Company	131.8	140.1	121.1
South Metropolitan Company	133.2	138.7	125.8
Commercial Company	127.24	133.3	117.7

	1909—Gross.			1909—Net.		
	Aver.	Max.	Min.	Aver.	Max.	Min.
Gas Light and Coke Co.	145.8	154.7	138.5	130.0	138.8	123.6
South Metropolitan Co	150.2	155.4	134.3	132.8	139.6	125.6
Commercial Co.	141.64	148.9	136.2	126.19	132.4	120.4

On comparing the figures in this table with those already given for the 6 weeks next before the periods in question, as given in the *Journal* of the 9th ult., it will be seen that the average net calorific power in 1908 was in the second half of the quarter practically the same as in the first. In regard to the gas supplied by the South Metropolitan Company and by the Commercial Company, the same remark holds good also for the first and second halves of the quarter in the present year. The Gas Light and Coke Company, however, have, during the last 7 weeks, supplied gas averaging nearly 1½ calories per cubic foot below that supplied in the first 6 weeks of the year. This slight falling off in calorific power is curiously enough accomplished by a rise from 16.63 to 16.81 candles in the average illuminating power of the gas as tested by the standard "Metropolitan" argand burner, and by a somewhat smaller rise in the illuminating power in the flat flame burner. Incidentally it may be remarked also, that the gas supplied by the Commercial Company has

1. The precise periods are 7 weeks ending March 28, 1908, and 7 weeks ending March 27, 1909.

shown an almost precisely similar rise in its illuminating power in the standard argand burner, as compared with the average for the first 6 weeks of the quarter, though in the case of this Company there is no perceptible change in the calorific power. The gas supplied by the South Metropolitan Company (the average gross calorific power of which is identical in the two halves of the quarter) curiously enough showed a fall from 16.40 to 16.34 candles in the average illuminating power in the standard argand burner, and from 10.93 to 10.64 candles in the flat flame burner.

The one point which stands out prominently in a survey of these and similar figures for testings of illuminating power and calorific power is the erratic character of the results obtained with the flat flame burner. After 3 years' experience of these testings for the purpose of "information," the question seems ripe for consideration whether any good purpose will be served by a continuance of them. The information they have afforded has tended only to demonstrate that the results of such testings are so erratic as to be inherently untrustworthy, and to be of no public utility.

It will now be useful to give a comparative statement (Table II.) of the average results of the testings of illuminating power and calorific power for the first 13 weeks, or first quarter, of 1907, 1908 and 1909.

TABLE II.—*Average Results of Testings.*

First Quarter, 1907.

	Illuminating Power.		Net Calorific Power.
	Argand.	Flat Flame.	
	Candles.	Candles.	Calories per Cubic Foot.
Gas Light and Coke Company.....	16.7	11.8	133.7
South Metropolitan Company.....	16.2	11.13	134.4
Commercial Company.....	15.25	9.35	127.35

First Quarter, 1908.

	Illuminating Power.		Net Calorific Power.
	Argand.	Flat Flame.	
Gas Light and Coke Company.....	16.77	11.99	132.1
South Metropolitan Company.....	16.24	10.81	133.0
Commercial Company.....	15.048	9.074	127.35

First Quarter, 1909.

	Illuminating Power.		Net Calorific Power.
	Argand.	Flat Flame.	
Gas Light and Coke Company.....	16.73	11.77	130.6
South Metropolitan Company.....	16.37	10.77	133.1
Commercial Company.....	14.816	9.018	126.07

The outstanding feature of the averages recorded in this table is the consistent uniformity of the quality of the gas supplied by the three Companies in the same quarters of the 3 years. But for the apparent depreciation of the flat flame value of the gas supplied by the South Metropolitan Company in 1908 and 1909 as compared with 1907, when a different flat flame testing burner was in use, and the tendency of the Commercial Gas Company to reduce the illuminating power of its supply to one more nearly in consonance with its statutory standard of 14 candles, it might be said broadly that there has been no change in any respect in the quality of the gas supplied. It has been pointed out, in a former article, that the present flat flame testing burner appears to be less suited for developing the full lighting value of the gas than that which was prescribed for the testings of 1907; and it is now clear also that the flat flame testings generally give somewhat erratic results. Consequently, practically no significance need be attached to the falling off in the flat flame values. In regard to the relation between the standard argand illuminating power of the gas and the net calorific power, which, in view of the standard of calorific power which the Gas Light and Coke Company have considered it expedient to accept, is of special interest at the present time, it may be noted that with a mixed gas supply such as that afforded by the Commercial Gas Company, if the illuminating power of the gas were in fact 14 candles instead of nearly 15, the net calorific power would certainly be below the standard of 125 calories per cubic foot which the Gas Light and Coke Company have accepted. On the other hand, it may be inferred from the following statement of the minimum results of testings of illumi nating power and calorific power in the first quarters of the 3 years, that there is not much likelihood of the calorific power falling below the value of 112½ calories per cubic foot, which is the limit above which the Gas Light and Coke Company must maintain the value of their gas to avoid the risk of incurring a penalty.

TABLE III.—*Minimum Results of Testings.*

First Quarter, 1907.

	Illuminating Power, Argand.	Net Calorific Power.
	Candles.	Calories per Cubic Foot.
Gas Light and Coke Company.....	15.6	119.3
South Metropolitan Company.....	14.3	122.8
Commercial Company.....	14.1	118.5

First Quarter, 1908.

	Illuminating Power, Argand.	Net Calorific Power.
Gas Light and Coke Company.....	15.79	121.1
South Metropolitan Company.....	14.06	125.4
Commercial Company.....	13.90	117.7

First Quarter, 1909.

	Illuminating Power, Argand.	Net Calorific Value.
Gas Light and Coke Company.....	15.61	122.7
South Metropolitan Company.....	14.50	122.3
Commercial Company.....	13.07	119.2

Having regard also to the fact that the gas may on a single testing fall slightly below 112½ calories net per cubic foot (provided the average of 3 days' testings is above that figure, without a penalty being incurred), it would seem that the Gas Light and Coke Company should be able, in all ordinary conditions of working, to escape that indignity. There is, however, the catch penalty limiting value of 106½ calories per cubic foot, which must not be underpassed in any single day's testings if a forfeiture is to be avoided. As suggested in our editorial columns last week, in conceivable circumstances of manufacture and supply this catch penalty testing may prove a real burden to the Company's Engineers, and can scarcely be held to afford any further real protection to consumers than the general provision that the average of any 3 consecutive days' testing must not fall below 112½ calories.

There are some other points in connection with the summaries of the results of testings made in the testing places under the control of the London County Council, to which we propose to revert in a subsequent article.

Technical Welfare Work.

Mr. Sydney W. Ashe, writing in the *Electrical World*, says that 3 years ago the Edison Illuminating Company, of Brooklyn, instituted a series of lectures on electrical engineering for their employees, of which the writer was given charge. This idea has since developed into an extensive system of educational work, now being carried on by the New York Edison Company, the Edison Illuminating Company, of Boston, as well as its originator, the Edison Illuminating Company, of Brooklyn. After 3 years' experience in this work it seems appropriate now to ask whether the undertaking has been a success, and if so, wherein have the various companies benefited. It is hardly necessary to go into the mechanics of this work, as the details have been given from time to time in the various issues of the *Electrical World*. The remarks of the writer will therefore be confined to the latter question. Increased loyalty of the men to their respective companies has been the first great benefit of this work. The personal interest of the various managements in their men has created a very kindly spirit and a feeling of pride in the home com-

pany. The men have felt that an effort was being made to raise their technical standard so that they could advance and in time occupy positions which now have to be filled by outside talent. The question may be asked as to whether the work would not in time serve to make the men discontented, whether they would not feel as they had attended all of the lectures in a season that they should immediately be promoted to general manager of the company. While it is true that a little knowledge is sometimes a dangerous thing, the results show that a little knowledge in this case has served more to whet the appetites of the men and make them realize their own limitations. They have become more earnest, more ambitious, more inquiring, less mechanical in their work, read the technical papers more, keep the librarians busy, have purchased many technical books and have kept themselves exceedingly busy.

The men have learned how to handle their apparatus in a more intelligent way, a slight mistake owing to ignorance of intelligent handling of apparatus often resulting in expense which would be far greater than the annual expense of the whole lecture course. In every lecture the particular points of danger in the handling of apparatus have been emphasized as most accidents are caused either by negligence or lack of realization of the full extent of the dangers which are always present, the possibilities of fatalities being thereby lessened. By having a better knowledge of things the men know better how to handle apparatus and to locate trouble. As the time element is so important a factor in time of emergency in the lighting field, it is evident how very important is this characteristic of being able to analyze things quickly. Where such extensive educational opportunities exist the men are more contented and there is less of a tendency to shift to other companies, or, in other words, there is more of a spirit of "once an Edison man always an Edison man." The men also get a better idea of the whole of which they are a part.

These courses have usually been given in co-operation with the benefit associations of the various companies and have served to strengthen these associations, resulting in increased membership. For instance, in Boston a slight fee has been charged for the whole lecture course, as follows: $1 if the applicant is a member of the company and a member of the benefit association; $2 if he is a member of the company, but not a member of the benefit association, and $3 if he is not a regular employee, but a member of an affiliated wiring company. This method has increased somewhat the membership of the benefit association, has limited the attendance to those most interested, has served to flatten the attendance curve and has resulted in raising about $500 toward the expense of the course.

A very successful feature of this year's work in Brooklyn was the introduction of the supplementary talks given by the department heads and assistants at the lectures. These talks were limited to 20 minutes so as to relieve the department head of the burden and responsibility of preparing a lecture. The result of this system has been very gratifying, as it did much toward creating confidence in the men and also created a friendly competition between departments. It is rather interesting in this connection to note that the success of the meetings of the Brooklyn section of the National Electric Light Association has been due in no small measure to the co-operation of the men who gave the supplementary talks at the lectures. Fully two-thirds of the papers presented at these meetings and the discussions of these papers were owing to the men who had previously co-operated at the weekly lectures.

The enthusiasm of the lecture committee of the New York Edison Company was so great at the close of last year's course that they undertook to lay out and give this year an elaborate laboratory course in conjunction with the lectures. This course involved a very large amount of labor on the part of the lecture committee, but it has been quite successful.

The benefits of the educational work also extend to the lecturer in charge. He comes into close contact with men and with commercial practice, and is very quickly relieved of the frills and hobbies that are too often characteristic of teachers. The success of each individual course requires careful planning, close study of conditions and human nature, the ability to keep creating something new, the keeping of close watch on new developments in the art and an immense amount of patience. Where the instructor is associated with a technical institution the same methods can be brought into the classroom. The result is wholesome and is what our technical institutions need.

Care must be taken with this work not to overdo it or its many benefits will quickly disappear. When with the meetings of various engineering societies and two or three evenings a week of educational work, it reaches a point where a man is at work each evening and feels that he is neglecting his duty if he does not keep up this pace, it is time to give the whole matter a rest. However, this result can be avoided by limiting the educational work to one or two evenings per week, and then, if there are men who feel that they do not obtain sufficient benefit, they should be encouraged to attend some of the evening courses in our technical institutions.

The writer feels that the above work has done much to awaken the men and arouse their enthusiasm, has been a good asset for the various companies and has been a valuable experience for himself.

The Origin of Anthracite Coal in England.[1]

The causes that have contributed to the formation of the anthracite coal measures, particularly in South Wales, have for a long time been a fruitful source of speculation among geologists. This is, perhaps, not surprising, for the subject is surrounded by so much conflicting evidence that varying theories are to be expected. In all such cases proof is difficult, if not impossible. As far back as 1840 it was pointed out by Mushet, in papers on iron and steel, that coals of different qualities are associated with similar strata; that the coal only, and not the accompanying measures, is changed. The change, however, cannot be accounted for by contact with trap-rock. Mushet was of opinion that the cause may have been due to fermentation, and the temperature caused thereby, during the period of transition from wood or vegetable matter into coal, but he did not think that this took place during the period of submersion. De la Beche, writing in 1846, found no evidence to show that there was any original difference between anthracite and bituminous coals, the whole being, in the first case, bituminous. The change to anthracite he looked upon as being due to subsequent change caused by the volatile compounds formed by decomposition having carried off relatively greater proportions of hydrogen and oxygen than of carbon. Disturbance of the strata was not responsible for it. In support of this last view he quoted the fact that the coal measures at Merthyr Tydfil were not more disturbed than those at Pontypool, nor those at Hirwain more than those at Pyle. Near the Mendip Hills also, where the coal is not anthracite, the measures are far more contorted than are many of the anthracite measures of South Wales. Long continued high temperature was, he thought, capable of effecting the change, in support of which the fact that the lower beds were more anthracite than the upper beds was evidence. Another authority, Dr. J. P. Bevan, claimed, in 1859, that anthracitization was due to "trap rocks far below the surface which have never appeared," and it took place before the "upper coal measures were deposited." Another theory, propounded by Mr. Thos. Joseph, in the Transactions of the South Wales Institution of Engineers, in 1872, was that the change was due to magnetic or galvano-magnetic action long prior to the occurrence of faults. Other theories have been discussed, some reasonable, others with little apparent evidence to support them, one of the latter being that chlorine, disengaged by volcanic action, combined with the hydrogen of bituminous coal, while part of the hydrogen combined with the oxygen of the coal to form water. Some portion of what would have formed ash in the coal was supposed to be carried away as chlorides.

Out of all the theories a sort of general agreement appears to have been come to that, at any rate, the anthracite character of certain coals had been brought about in coals that were originally bituminous. Explanations had roughly been resolved into three: That the anthracite seams had been more deeply buried, and consequently had been subjected to a higher temperature than the overlying strata; that they had been altered by the intrusion of plutonic rocks, and that they were more affected by slip cleavage. None of these theories appears, however, to be without serious objections. Recent investigations have thrown some light on the subject, and theories that have for a good many years been regarded with more or less favor must now be examined in this light, and some of them suffer considerably by the process.

Unfortunately for the belief that great depth and consequent high temperature were the cause of anthracitization, it has been shown that in the part of the coal field where the measures are thickest, and where the seams were most deeply buried in carboniferous times, the coals are bituminous. With regard to the secondary rocks, also, which were subsequently spread over the coal measures, they were thickest in the southern and bituminous region, and thinnest over the northern, or anthracite, part. Again, the trap-rock of Pembrokeshire, which, while in a molten state, was thought to have penetrated under the coal fields, is of pre-carboniferous age, and consequently can

1. *Engineering.*

have had no effect on the coal measures. In places where whin-sills have come in contact with coal in other districts, the coal has not been anthracitized, but coked; and the percentage of ash has largely increased.

From what is now known, it does not appear that slip cleavage is developed in anthracite seams, and the theory that escape of volatile gases is responsible for anthracitization does not accord with present knowledge. The distribution of anthracite in Ireland does not support the theory that the cause was due to disturbance of the strata. Other causes must, therefore, be sought. One thing seems clear, however, which is, that the theory of the seams having been altered by one common cause, acting subsequently to their deposition, as, for example, regional metamorphism, must give way.

Since the year 1901, investigations have been carried out by Mr. A. Strahan, F.R.S., and Mr. W. Pollard, F.G.S., with a view of obtaining as much evidence as possible bearing on the causes of anthracitization, the result of their labors appearing last year in the form of a memoir on the "Coals of South Wales," published by the Geological Survey of England and Wales. The investigation entailed a great amount of work, including the making of a large number of analyses of different coals.

As far as can now be told, the anthracite region must have lain, for the most part, outside the northwestern margin of the main coal field, and to the west of it in Pembrokeshire, but the greater part of it has been removed by denudation. From the remaining part, however, geologists are enabled to judge that it extended in a direction a little south of west, and it is probable that it never reached beyond Monmouthshire in an easterly direction. Its limit to the west is unknown. Investigations have shown that the depth from the present surface has nothing to do with anthracitization. In the anthracite regions the coals are anthracitic up to their outcrops, while in the bituminous districts the coals continue to be bituminous to the lowest depths to which they have been followed. From this it may be assumed that the coals had attained their present character before denudation had done its work on surface configuration. Another matter of distinct importance as evidence in favor of this view is the marked freedom from ash of the anthracite coals when compared with bituminous coals. Now it is obvious that if anthracite coal had ever been bituminous coal, its change from the latter state to the former would naturally mean a loss of bituminous matter, and consequently an increase in the percentage of ash. The remarkable freedom of anthracite coal from ash is well known, for it is one of its chief characteristics. By ash is, of course, meant all non-combustible residue. It may be due to slaty films, pyrites, sulphates and carbonates, which are found in the coal, in addition to which there may be organic material supplied by the plants which formed the coal.

In order to find out what percentage of ash is contained in a mass of miscellaneous plants, and the alteration effected by spontaneous heat, experiments have been made with meadow hay, two samples of which were taken from the same rick, some from the outer layers, not subject to much heat, and some from the center of the rick, where the hay had been much heated and had become almost black. Both samples where dried at 105° C., and were then analyzed in a manner exactly like that adopted with coal. The result showed that in the dark heated sample from the interior of the stack the percentage of ash was 9.28, and in the sample taken from the outside of the stack, where there had been little heating, it was 7.61. The net result of the heating was to diminish the percentage of hydrogen, oxygen and nitrogen, with a corresponding increase in the percentage of carbon and ash.

The conclusions arrived at by Mr. Strahan may be summed up as follows: (*a*) The seams are not all similarly anthracite, and though each seam is generally more anthracitic than the one above it, there are many exceptions to this rule. (*b*) The anthracitic character was not due to faults, but existed before the faults were formed. (*c*) The anthracite existed as such before the coal field was reduced by denudation to its present dimensions. (*d*) The percentage of ash diminishes *pari passu* with the decrease of bituminous matter. From these conclusions we gather that the variations in the composition of the coals were original, or, at any rate, of very early date, for the denudation of the coal fields and the disturbances of the strata took place in the main before the Triassic period, and, therefore, before any of the secondary rocks were laid down. There does not seem to be any evidence to carry us further than this, but things point to anthracitization having been contemporaneous with the deposition of the coal measures.

Geologists appear to be able to give us no explanation of the distribution of anthracite, though attention may be called to the fact that coals are known to vary in character, both according to the kind of vegetable remains, as well as to the parts of plants of which they are formed, and also that the vegetable mass is preserved according to local circumstances.

In all that has been said, however, with regard to the anthracite character of the coals in parts of South Wales being due to original conditions of deposition, the fact that changes are liable to occur in the process of time is granted. As a general rule, coals associated with older formations approach more nearly the anthracitic condition than those of later date. Put briefly, all the information on this subject which has, up to the present, been obtained, points to the conclusion that, whatever causes of alteration subsequent to deposition of the coal may have been, there does not appear to be one of them adequate to modify more than to a very small extent the differences due to original composition.

Bureau of Information, The American Gas Institute.

Under the direction of the Institute it has been decreed: 1. That the privilege of submitting questions be limited to members of the Institute. 2. Neither the Board of Directors of this Institute, nor the Institute as a body, make themselves in any way responsible for the statements of fact or expressions of view given out by the Bureau of Information.

BUREAU OF INFORMATION, THE AMERICAN GAS INSTITUTE,
HEADQUARTERS, 1943 COMMERCIAL NATIONAL BANK BUILDING.
W. A. BAEHR, Chairman. CHICAGO, ILLS., April 26, 1909.

The following questions have been received by the Bureau:

Question No. 52.—"What companies are using automobile trucks in any part of their distribution work; and do they find same to be an economical investment?"

Question No. 53.—"What is the best method employed for taking candle power of illuminating gas with a bar photometer? Which is preferable, a star disk or the circular grease spot?"

Items of Interest
FROM VARIOUS LOCALITIES.

IN addition to the storage holder that the Western Gas Construction Company will construct for the Mt. Carmel (Pa.) Company, the same contractor has agreed to construct a holder for the Bristol (R.I.) Company, the vessel to have a capacity for retaining 50,000 cubic feet.

WE are in receipt of the Bristol Company's latest Bulletin (No. 103), which describes several of the Company's recording instruments particularly adpated for use in connection with its pressure gauges, recording thermometers, electric time recorders, and indicating and recording pyrometers. The text carries full explanation as to how these valuable instruments may be applied.

"E. A. W.," writing to us from Terre Haute, Ind, under date of the 1st inst., says: "I thought you might be interested to know that during the week of April 19th Mrs. Helen Armstrong gave cooking lectures in this city, in the interest of the Citizens Gas and Fuel Company, that were very well attended. The average attendance easily ranged from 300 to 500. We considered the lectures given by Mrs. Armstrong a success in every respect."

MR. J. C. GRAY, formerly in charge of the New Business division of the Des Moines (Ia.) Gas Company, has accepted a prominent place in the corresponding division of the Omaha (Neb.) Company.

ACCORDING to the statement handed to the officials of Philadelphia by the United Gas Improvement Company, for the quarter ended March 31st, the gas sales in Philadelphia amounted to 2,120,005,600 cubic feet. The output for the corresponding quarter in 1908 amounted to 2,142,893,000 cubic feet, or a decrease for this year's output, in the quarter, of nearly 23 million cubic feet.

THE annual meeting of the Northern Liberties Gas Company, of Philadelphia, Pa., will be held at 2:30 P.M. to-morrow.

MESSRS. J. A. JONES and associates have petitioned the authorities of Carmine, Wyo, to grant them a franchise under which they may construct a works and distribute gas for a period of 50 years. They agree to consent to maximum rates thus based: On illuminating, $1.75 per 1,000; on cooking, heating and power account, $1.50 per 1,000. It is further agreed that the third year after beginning to operate the Company shall pay to the city treasury, $250; the fourth year, $350; and $400 annually thereafter. It is estimated that an expenditure of $100,000 will be necessary to construct the plant.

THE Fort Wayne *Gazette*, of April 28th, says that the boiler shops of the Western Gas Construction Company are running full time (10 hours per day) and that the force is nearly up to the number required when rush jobs are on hand.

HERE is a plaint from a recent issue of the Greenwich (Conn.) *Graphic*, that is fairly reflective of the "state of mind" of the average resident of that handsome suburban city, over the fact that someone or something is actively preventing them from having a gas supply: "East Port Chester goes Greenwich one in that it has gas and Greenwich hasn't. We notice they are laying more gas pipes in

that section. What a pity the Westchester Company couldn't extend its service to Greenwich village, which it might do very easily—but the Connecticut Company won't let it—and thereby give us something that is denied us by that monopoly, the Connecticut Company. And what a paying investment it would be for the Westchester Company. This town will never be what it should be until we have gas; whether it does or not depends upon the people of this town. There certainly is money enough, and that ought to be influence enough to compel the Connecticut Company to give us what was promised long ago, or else let some other company come in and supply us with what is urgently demanded. It's a shame to be so held up by a grasping monopoly, which will neither do what was promised, nor will it let anybody else do it if it can prevent it. A mass meeting or something of that kind might tell the New York and New Haven Road that there is a limit to its power. The value of property would be increased greatly if we could have the benefit of gas. It is time to do something."

THE generator rooms, and the rooms adjoining, of the Plymouth (Mass.) Electric Light Company were badly damaged by a fire that broke out in the former some evenings back. The loss from fire and water is put at $38,000, and is fully covered by the insurance carried.

THE Brandon Gas and Power Company, of Winnipeg, Manitoba, has applied to the proper authority for the right to increase its capital in the sum of $100,000. The present capital is $150,000.

THE gas plant of the Gallipolis (O.) Gas and Electric Company will be shut down the 20th inst. The electric division will be kept in service. Natural gas is plenty and cheap in Galion, and steam coal is also cheap. Hence the determination.

THE Peoples Gas Light and Coke Company, of Chicago, Ills., has purchased five "skimabouts" of the Palmer and Singer type of auto, which will be used to transport the Company's inspectors.

THE Denver (Col.) *Post* is our authority for the statement that Mr. Frank W. Frueauff, the Vice-President of the Denver Gas and Electric Company, is in line for the Presidency of the National Electric Light Association, the annual meeting of which body will be held in Atlantic City, N. J., the first week in June. The Association, of a surety, could not name a better man than "busy Frank."

THE City Attorney of Montgomery, Ala., has ruled that it is beyond the right of the Montgomery Light and Power Company to charge a monthly rental for gas meters under the guise of a readiness-to-serve basis. The Company, rather mistakenly it would seem at this distance, raised that rental charge recently to $1 per month. The prior charge was 50 cents.

THE proprietors of the Bennington (Vt.) Gas Light Company have notified the residents that, from the 1st of the month, the gross rate per 1,000 will rule at $1.90, virtually an increase of 30 cents per 1,000.

MR. DANVILLE DECKER, Manager of the business of the Utah Light and Railway Company in Ogden, Utah, announces that the plant will be virtually reconstructed. The first change will be made in respect of the main system, that to be followed by a complete overhauling of the generating division.

WORK on the pipe lines connecting the residents of Southington with the main of the Meriden (Conn.) Company is underway. The Company has also completed title to its new purchase of a plot of land at the corner of Cooper and Meridian streets.

WHAT was known as the Blackstone merger Act, intended to facilitate the consolidation of certain gas and electric lighting interests of Rhode Island, has been ordered "indefinitely postponed" by the Legislature.

ACCORDING to the Philadelphia *Press*, in reporting that which was done and announced at the annual meeting of the United Gas Improvement Company, was the sum of close to $2,000,000 added to the surplus for 1908, bringing the total of that fund up to $2,437,179. The net profits for the year were $6,326,607, an increase for the 12 months of $325,561. By a vote of 682,657 shares President Thomas Dolan was re-elected, as also the following Directors: S. T. Bodine, Randal Morgan, C. A. Griscom, R. Ellis, W. Wood and M. L. Clothier. By a vote of 655,597 shares the stockholders decided to make a 10 per cent. increase in the capital stock, or from $918,005 to $1,009,467. The new stock will be sold at par, or $50, the market price being about $89. The new stock will be paid for in two installments of $25 each, one on June 15th, the other on October 1st. Shareholders of record of May 8th will have the right to buy this new stock. President Dolan gave the following detailed statement of that which it is proposed to do with this new stock, the allotment being in this nature:

	Gas Division.	Electric Division.
Improvements and extensions, works.	$1,594,241	$146,589
New mains for pressure and distribution purposes	1,666,981	56,585
Lines and services—meters and services—meters and transformers	868,628	30,000
Total	$4,129,950	$233,174

The 91,462 shares of new stock to be sold will bring into the Company's treasury the sum of $4,573,100, and it will make the total outstanding capital $56,472,350. According to the President's report the earnings for the year were $6,326,707.58, a gain of $325,561.03 over 1908, of which $3,670,788 went to the shareholders in the shape of dividends. The sinking fund investment list was increased in the sum and to the value of $678,500, to retire at the end of the lease the investment in the Philadelphia gas works. The sum of $1,917,419.38, carried to undivided profit account. The total net income derived from the income on securities owned, and from leased works, amounts to $7,216,911.57, and the expenses were $890,203. The second item in the expense account is that paid on account of taxes to the State of Pennsylvania, amounting to $298,944. The U. G. I. folks have the imposing sum of $61,218,492 invested in the securities of other companies—the real or market value of these is vastly higher than the figure quoted—that being the total purchase price. So that the wolf may be kept actually from the door, the Company's cash balance in bank footed up, the day prior to the meeting, the comforting total of $3,671,625.

THE proprietors of the Waltham (Mass.) Gas Company have voted to sell their electric current business to the Edison Illuminating Company, of Boston, and to dispose of their gas business to the Newton and Watertown Gas and Electric Company. The Chelsea (Mass.) Gas Company has agreed to dispose of its electric business to the Boston Edison Company for $350,000. The Massachusetts Gas Companies has sold all its electric trading and business to the Boston Edison Company, and the latter has sold to the former all of its gas interests in the State of Massachusetts. Mr. Charles L. Edgar, President of the Electric Illuminating Company, of Boston, explains that these absorptions, interchanges and agreements are to be taken as meaning that the Edison Company will keep out of the gas business, and that the Boston Consolidated Gas Companies will keep out of the electric business.

THE following are the sums paid by the named corporations of Providence, R. I., on account of royalties on gross receipts for the quarter ended March 31:

	Providence Gas Co.	Narragansett. Electric Co.
March 31, 1909	$8,814.01	$12,701.68
" " 1908	8,306.41	12,067.98

THE franchise for constructing and operating a gas works in Bessemer, Ala., which was secured some time ago by Messrs. Langenbach and Kaufman, has been signed, and the Bessemer Gas Company will be forthwith in the market for gas apparatus.

MR. GEORGE T. FOOTE has been appointed Gas Inspector for Kansas City, Kas. He is a well-known railroad man, having for many years acted as joint agent at the Union Railroad depot for all the steam lines entering Kansas City.

THE Messrs. Waldo Brothers, of Boston, Mass., were the lowest bidders on the invitation of the U. S. Government to bid on the benchwork reconstruction that is to be made this summer on the West Point (N. Y.) Military Academy gas plant.

THE Gas Bench Construction Company, of St. Louis, Mo., has been awarded the contract for installing two of its modern half-depth type of recuperative settings in the works of the Hattiesburg (Miss.) Traction Company.

THE Laclede-Christy Clay Products Company, of St. Louis, Mo., reports brisk business with an appearance in the market indicative of still more pronounced activity. Refillings have been ordered thus: 12 benches of 9's, Denver, Col.; 8 of 9's, Dayton, O.; 3 of 8's, at Detroit, Mich.; 3 of 6's, at Fort Worth, Tex.; and smaller orders respectively from Bedford and Columbus, Ind.; Springfield and Streator, Ills.; Louisiana, Mo.; Columbus, Ind.; Fairfield, Ia.; and Florence, Ala. Other orders on the books call for complete linings for water gas sets in the plants at Abilene, Dallas and Weatherford, Tex.

"J. E. T.," writing from New Haven, Conn., under date of the 4th inst., says: "The New Haven Gas Company is moving its showroom and appliance department from the Odd Fellows' Building to a large office structure adjoining its beautiful and commodious office building. The two are connected, so that you can step readily from the office to the showroom. The arrangement is complete and the *ensemble* adds greatly to the attractiveness of the Company's home."

THE AMERICAN GAS LIGHT JOURNAL

The Market for Gas Securities.

Last week, so far as the trading is gas shares was concerned, was quite like its predecessor—dull and strong. At noon to-day (Friday) the official quotations were 137 to 137¼, which in reality are the quotations of a week ago. Brooklyn Union is up 5 points in the week, and there can be no doubt about it that these shares are being quietly picked up in a way indicative of the "something doing" order.

In out of town shares there was some good trading in Massachusetts common, and American Light and Traction also shows good improvement. Washington (D. C.) is 336¼ to 337, nominally. If these shares were worth 385 last week they are worth at least as much this week, and at the current quotations they surely are a purchase. The bond market continues brisk, with buyers evidently willing to concede the odd point to sellers.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

MAY 10.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated Gas Co.	$73,177,000	100	137	137¼
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	3,000,000	1,000	98	101
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	—	105
Mutual Gas Co.	3,500,000	100	155	165
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	100	101½
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	—	100	101
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	104	107
Con. 5's, due 1945, J. & J.	1,500,000	—	97	101
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	94	100
Standard	5,000,000	100	—	75
Preferred	5,000,000	100	70	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	134	135
1st Con. 5's, due 1948, M. & N.	15,000,000	—	91½	92
Yonkers	200,000	500	120	—
Out-of-Town Companies.				
Bay State	50,000,000	50	1¼	1¾
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	65
" 1st Mtg. 5's	500,000	1,000	90	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	60	60¼
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed Gold Bonds	7,600,000	1,000	104	108¼
Cincinnati Gas and Electric Co.	29,500,000	100	92	93
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. & Heating Co.	1,682,750	100	90¼	91
Preferred	3,026,500	100	75¼	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	—	105
Mortgages, 6's	3,600,000	—	—	118
Chesapeake, 1st 6's	1,000,000	—	—	—
Equitable, 1st 6's	910,000	—	—	—
Consolidated, 1st 5's	1,490,000	—	—	112
Consolidated, Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	—	—	100
Denver Gas and Electric	458,000	—	102	105
Detroit City Gas Co	5,000,000	50	—	50
" Prior Lien 5's	4,619,000	1,000	97	100¼
Detroit Gas Co., 5's	381,000	1,000	75	80
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	39	40
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co., 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	—	112	113½
" Bonds, 5's	10,500,000	—	103	103½
Indianapolis	2,000,000	—	60	70
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	92	—
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	—	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede Gas Co., St. Louis	10,000,000	100	—	100
Preferred	2,500,000	100	80	90
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,370,000	50	142	145
Madison Gas and Electric Co.				
" 1st Mtg. 6's	350,000	1,000	106	108½
" 6 per cent. scrip, due 1910	100,000	25	60	60½
Massachusetts Gas Companies, of Boston	25,000,000	100	63¼	64
Preferred	25,000,000	100	93½	93¾
Montreal Gas Co., Canada	2,000,000	100	218	218¾
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	56	58
Bonds, 6's	6,000,000	—	137	138
New Haven Gas Co.	2,000,000	25	200	—
Peoples Gas Lt. & Coke Co., Chicago	25,000,000	100	114¾	114¾
1st Mortgage	20,100,000	1,000	—	—
2d "	2,500,000	1,000	104	—
Rochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104½	105½
San Francisco Gas Co., Cal.	15,500,000	—	—	—
St. Joseph Gas Co.—				
1st Mtg. 5's	751,000	1,000	100	102
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgages, 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112¾	115
General Mortgage, 5's	2,465,000	1,000	90	95
Syracuse Gas Co., N. Y.	1,975,000	100	50	55
Bonds	2,047,000	1,000	100	104
Washington (D. C.) Gas Co.	2,600,000	20	336½	337
1st Mortgage, 6's	600,000	—	—	—

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Street Department—City of Boston.

STREET LIGHTING.

PRELIMINARY NOTICE.

The City of Boston will receive bids at the office of the Superintendent of Streets, 47 City Hall, Boston, Mass., for gas lighting in streets, alleys, etc., for a period of five years beginning September 15, 1909. Proposals will be received Thursday, July 1, 1909. Previous to the receiving of proposals it is desired that intending bidders furnish perfected apparatus for a practical demonstration under service conditions on Boston streets. The City will pay a reasonable cost of installation, not including the cost of lanterns, and will also pay the cost of maintenance at the rate now paid under the existing contract. An installation of not less than twenty (20) nor more than fifty (50) lamps is desired. No bid will be considered upon apparatus that has not been operated for purposes of observation and tests on Boston streets for at least one month.

GUY C. EMERSON,
April 28, 1909. Superintendent of Streets.
1770-1

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By Graduate of Boston Cooking School as Lecturer and Demonstrator for Gas Companies.

An experienced person with best of credentials from most every city of note in the United States.

Address, S. E. CRAIG,
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Position Wanted

As Foreman in Either Coal or Water Gas Plant.

Twelve years' experience. Also understand all kinds of construction work. Can show results. At present employed. First-class references.

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By a young man of 23, with 4 years' experience in the coal gas business. Opportunity more essential than salary. A-1 references.

1770-1 Address, "J. B. W.," care this Journal.

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An all-round gas man, married, 5 years' experience with one company, wants position as gasfitter or gas maker with small company. O.K. references. Address,

1770-1 CHAS. KARLICK, Bay Shore, L. I.

Position Wanted

As Superintendent,

By a competent gas man who has had practical experience in all branches of the business, both coal and water gas. At present employed. A-1 references.

1755-tf Address, "R. C.," care this Journal.

Position Wanted.

On or before May 1st I shall be open for a position as superintendent or manager of a gas or electric property or of a combined property. I am a graduate of a leading technical university and have had 6 years of actual operation in the above lines. I am obliged to look for a position because of a complete change in the management of the companies I am now employed with as assistant to the president. I can refer directly to him as one of my references, and also to several leading gas and electrical engineers as to my ability and character. I am 29 years of age. Address reply to "M.,"

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One who has had experience in laying street mains, services, gasfitting and complaint work and can handle a number of men. We shall make him shop foreman and expect him to show results. To such a one we can offer a steady position with prospects. None others need apply. Please state wages desired, when you can report, inclose references and address

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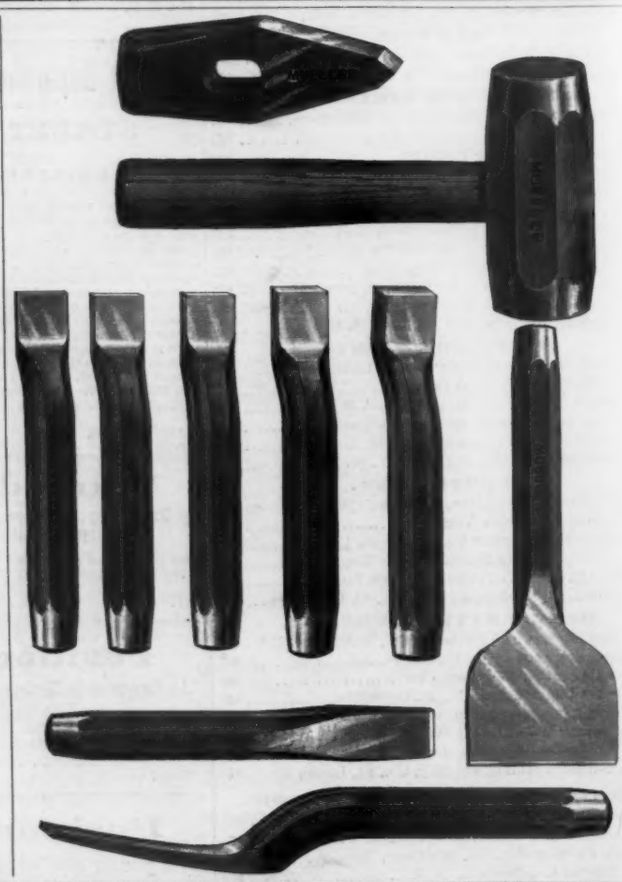

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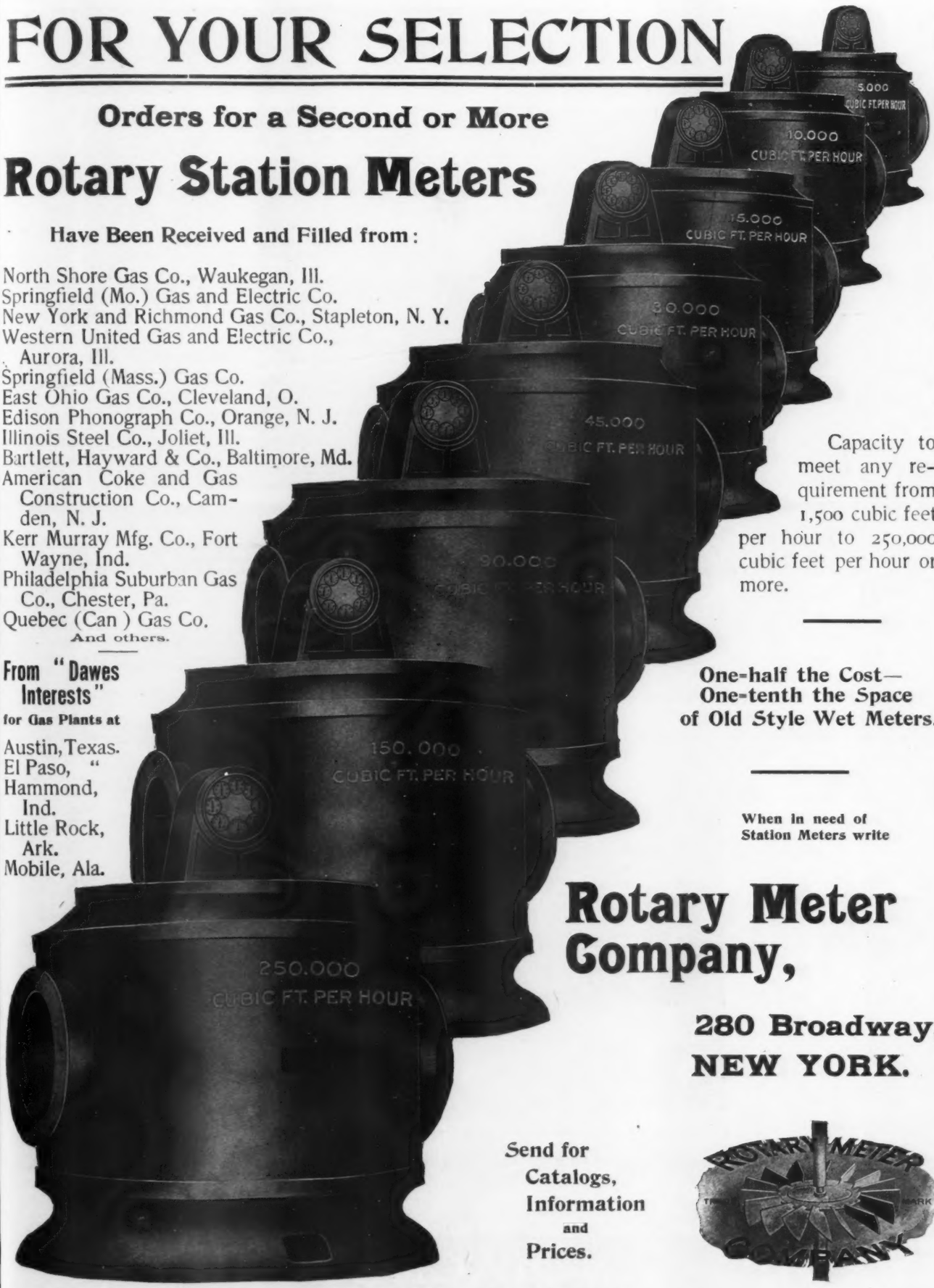
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90,000
150,000 CUBIC FT. PER HOUR
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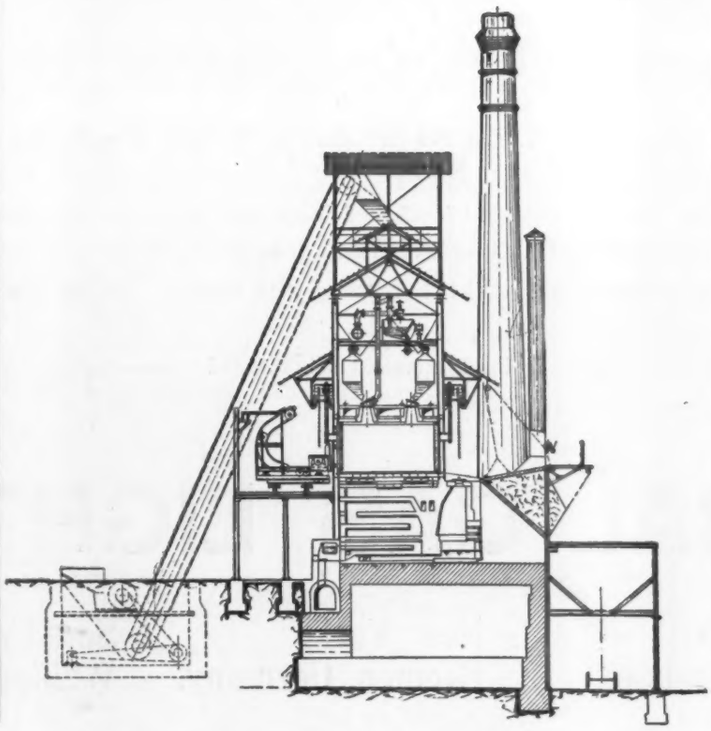

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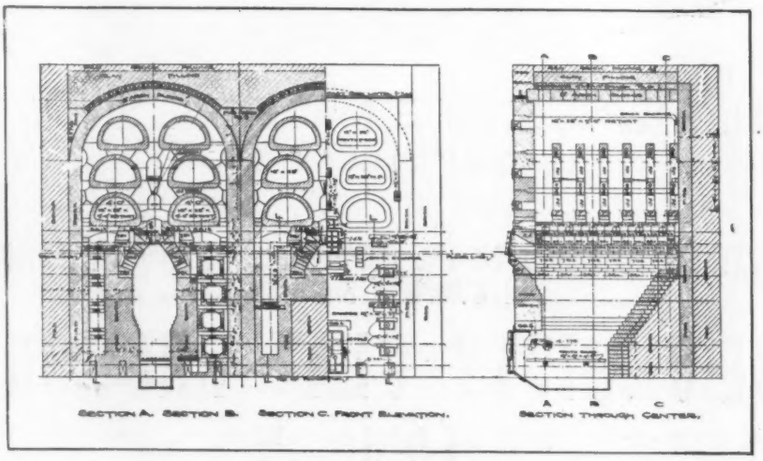

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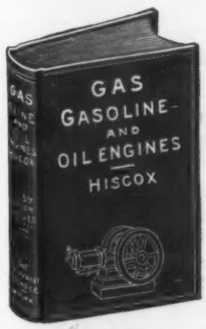

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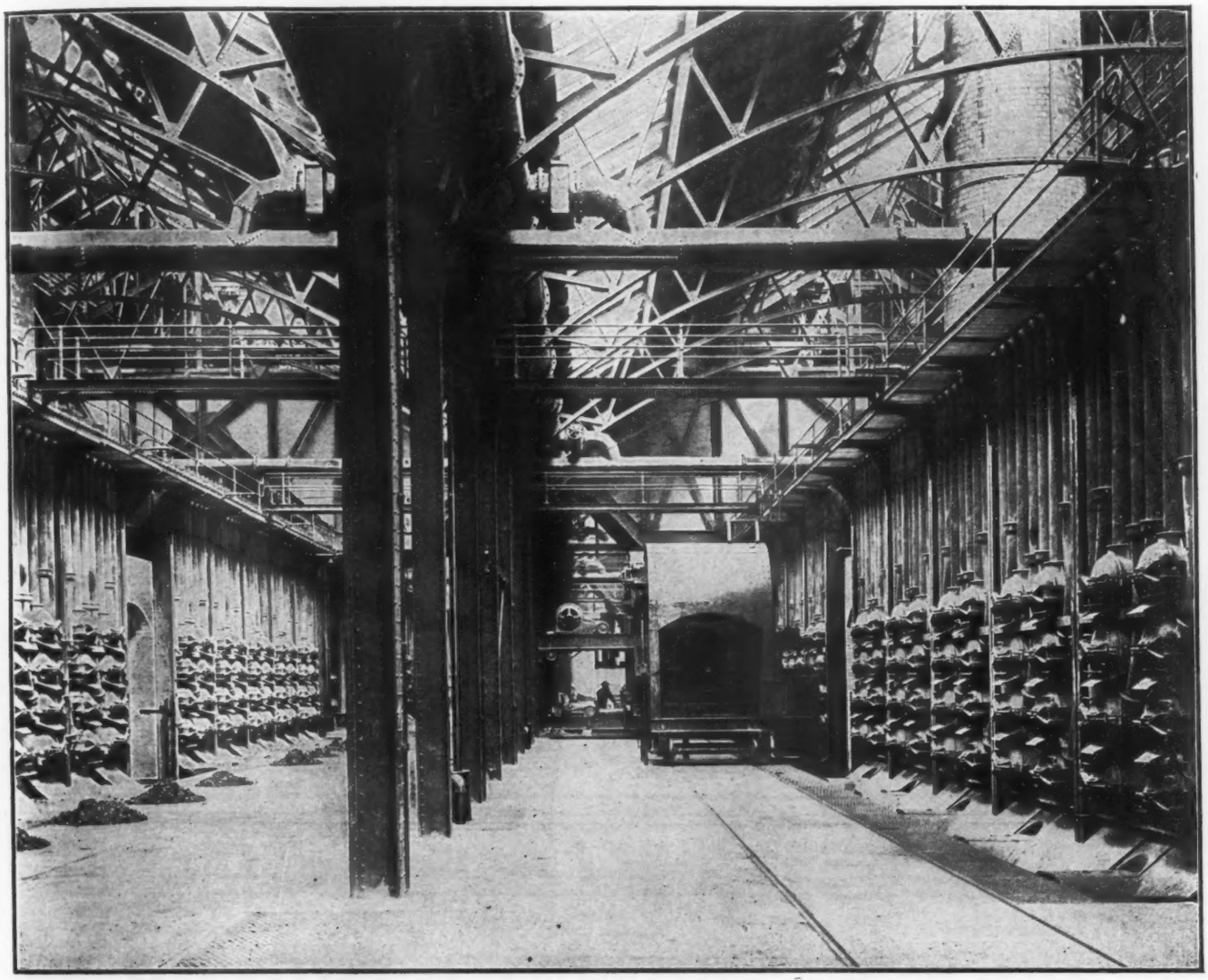

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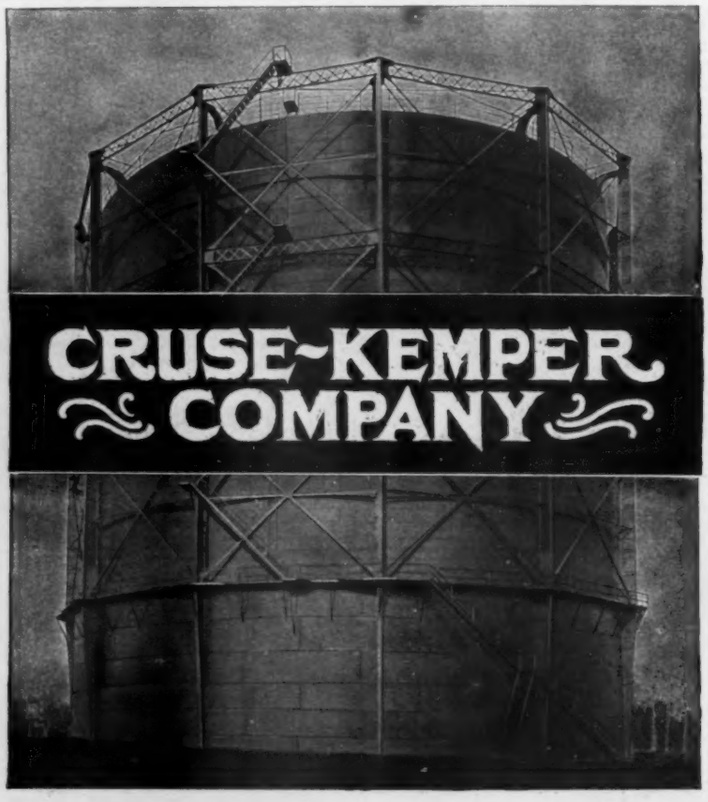

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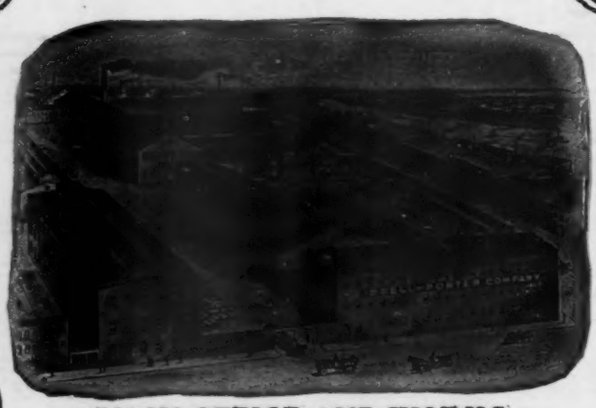

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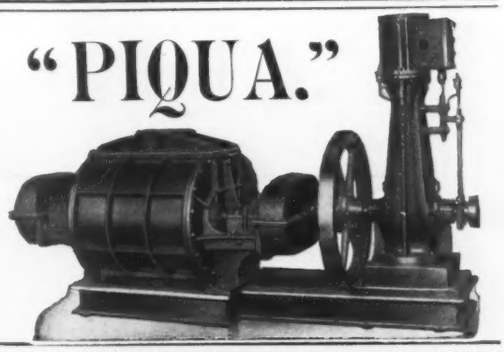

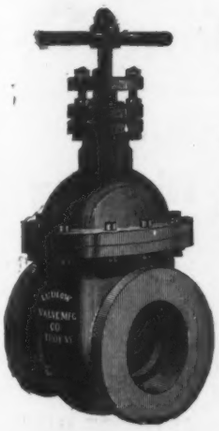

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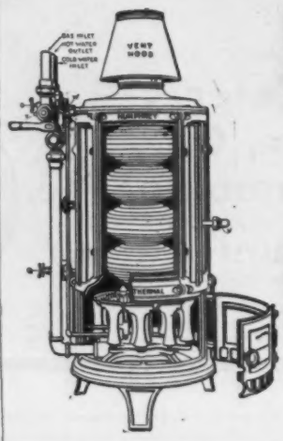

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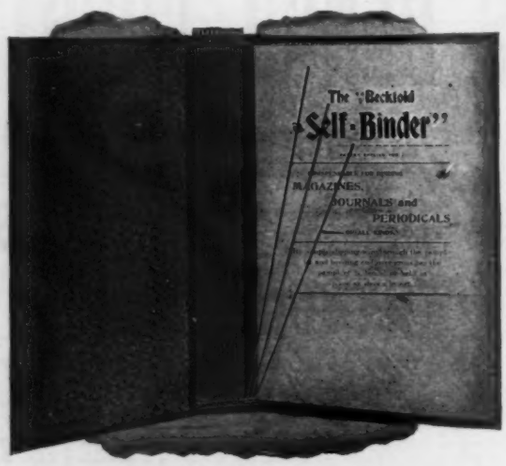

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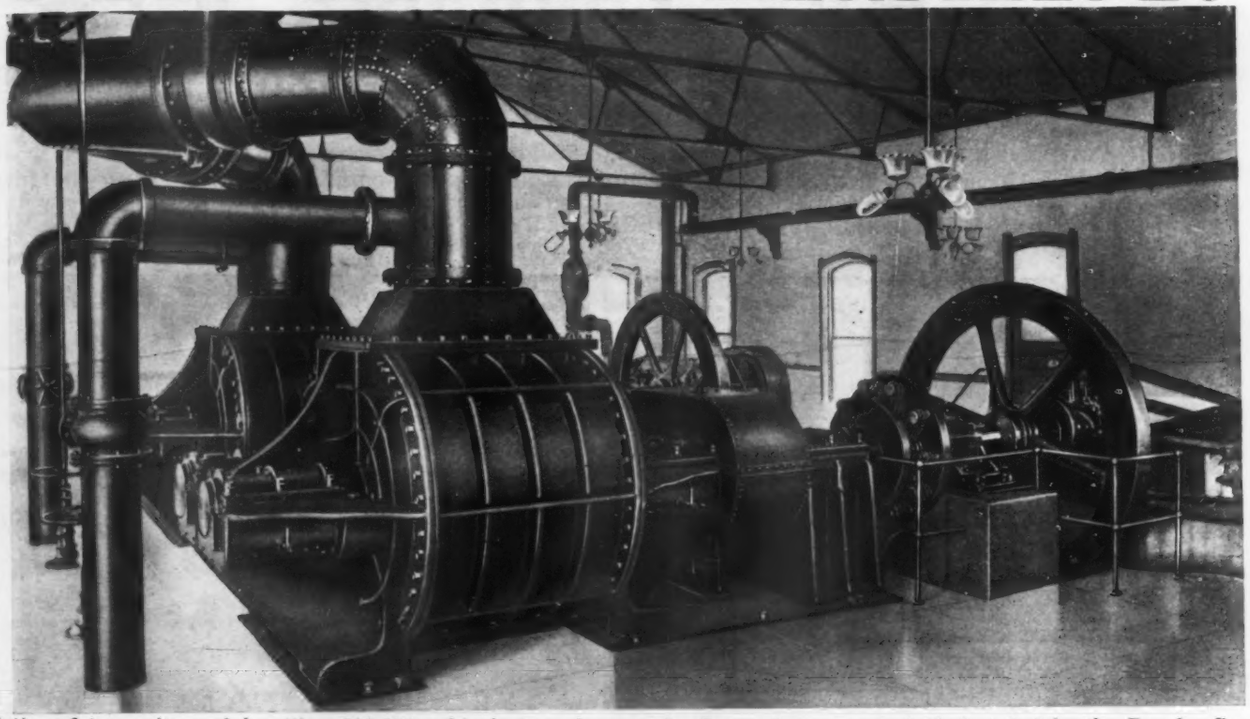

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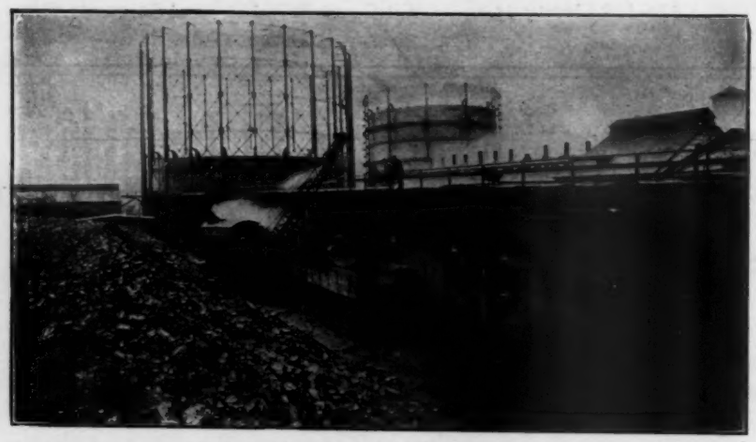

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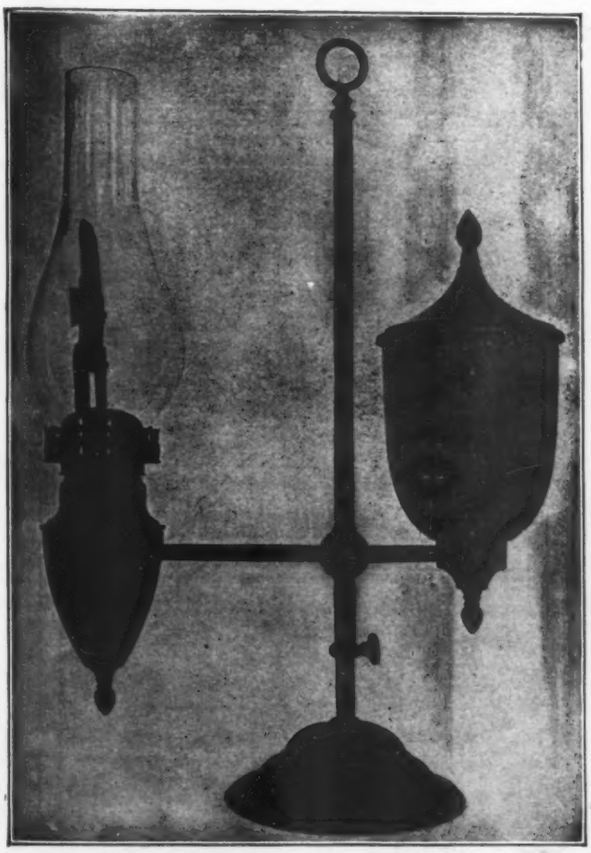
Sat.	1	3.00AM	4.00AM
Sun.	2	3.20	4.00
Mon.	3	3.40	4.00
Tue.	4	No L.	No L.
Wed.	5	No L FM	No L.
Thu.	6	No L.	No L.
Fri.	7	7.30PM	10.20PM
Sat.	8	7.30	11.30
Sun.	9	7.30	12.30AM
Mon.	10	7.30	1.20
Tue.	11	7.30	2.00
Wed.	12	7.30LQ	2.40
Thu.	13	7.30	3.10
Fri.	14	7.30	3.40
Sat.	15	7.30	3.40
Sun.	16	7.40	3.40
Mon.	17	7.40	3.40
Tue.	18	7.40	3.40
Wed.	19	7.40NM	3.40
Thu.	20	7.40	3.40
Fri.	21	7.40	3.40
Sat.	22	7.40	3.40
Sun.	23	7.40	3.40
Mon.	24	11.10	3.40
Tue.	25	11.50	3.40
Wed.	26	12.10FQ	3.40
Thu.	27	12.40	3.40
Fri.	28	1.00	3.40
Sat.	29	1.20	3.40
Sun.	30	1.50	3.30
Mon.	31	2.10	3.30

TOTAL HOURS DURING 1909.

By Table No. 1.

	Hrs.Min.
January	212.20
February	183.40
March	173.00
April	151.10
May	144.10
June	138.50
July	145.40
August	160.30
September	180.00
October	201.00
November	216.30
December	233.40
Total, yr.	2140.30



THE ELLIOTT KEROSENE STANDARD PHOTOMETER LAMP.

✻✻✻

10-Candle Power.

✻✻✻

This lamp is a perfect substitute for the 10-candle Pentane Lamp hitherto used, and has the following advantages:

1st. It uses Standard Kerosene Oil (Pratt's Astral Oil or equivalent).

2d. It is remarkably steady. Will burn 24 hours continuously with less than 2 per cent. variation.

3d. It is much less dangerous than Pentane, which is a kind of gasolene.

4th. It is not easily affected by air currents in the photometer room.

5th. Since the lamp may burn continuously, the candle power of gas may be taken at any moment, if necessary. This insures steady illuminating power without waste of carburetting material.

6th. The first cost of the lamp brings it within the reach of even small gas works.

7th. Costs much less to maintain than a Pentane lamp or sperm candles doing the same service.

8th. Is not affected by the weather.

PUBLIC LIGHTING TABLE.

MAY, 1909.

Table No. 2.
NEW YORK CITY.
ALL NIGHT LIGHTING.

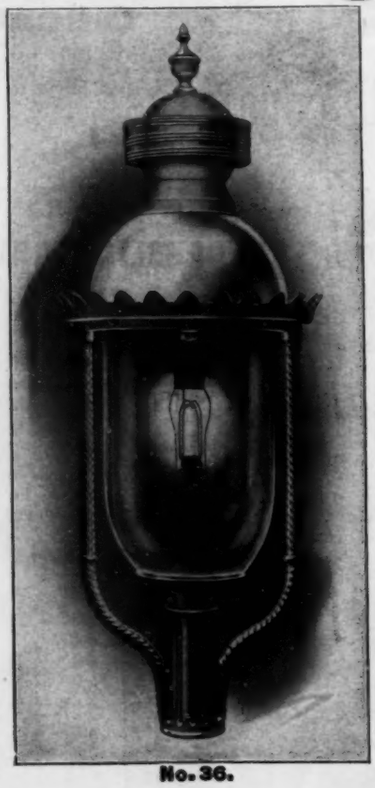
Day of Week.	Date.	Complete Lighting in One Hour	Complete Extinguishing in 50 Minutes
		From Time Given	
		P. M.	A. M.
Sat.	1	6.47	3.52
Sun.	2	6.47	3.52
Mon.	3	6.47	3.52
Tue.	4	6.47	3.52
Wed.	5	6.47	3.52
Thu.	6	6.47	3.52
Fri.	7	6.57	3.42
Sat.	8	6.57	3.42
Sun.	9	6.57	3.42
Mon.	10	6.57	3.42
Tue.	11	6.57	3.37
Wed.	12	6.57	3.37
Thu.	13	6.57	3.37
Fri.	14	7.07	3.27
Sat.	15	7.07	3.27
Sun.	16	7.07	3.27
Mon.	17	7.07	3.27
Tue.	18	7.07	3.27
Wed.	19	7.07	3.27
Thu.	20	7.07	3.27
Fri.	21	7.12	3.22
Sat.	22	7.12	3.22
Sun.	23	7.12	3.22
Mon.	24	7.12	3.22
Tue.	25	7.12	3.22
Wed.	26	7.12	3.22
Thu.	27	7.12	3.22
Fri.	28	7.12	3.17
Sat.	29	7.12	3.17
Sun.	30	7.12	3.17
Mon.	31	7.12	3.17

TOTAL HOURS DURING 1909.

	Hrs.Min.
January	428.30
February	358.15
March	353.10
April	298.10
May	263.20
June	234.45
July	248.30
August	278.00
September	311.25
October	370.05
November	397.40
December	438.35
	3980.25
Deduct on account of 50 min. extinguishing time	30.25
Total, yr.	3950.00

NEW YORK, 318 West 42d Street.
BOSTON, 820 Beacon Building.
PHILADELPHIA, Broad and Arch Streets.
ST. LOUIS, 712 Roe Building.
CHICAGO, 218 La Salle Street.
SAN FRANCISCO, 512 Oak Street.

WELSBACH STREET LIGHTING COMPANY



No. 36.

....OF AMERICA....

Controls and Operates the **Welsbach System of Street Lighting,**

Which includes its specially DESIGNED and PATENTED BURNER for PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 180 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

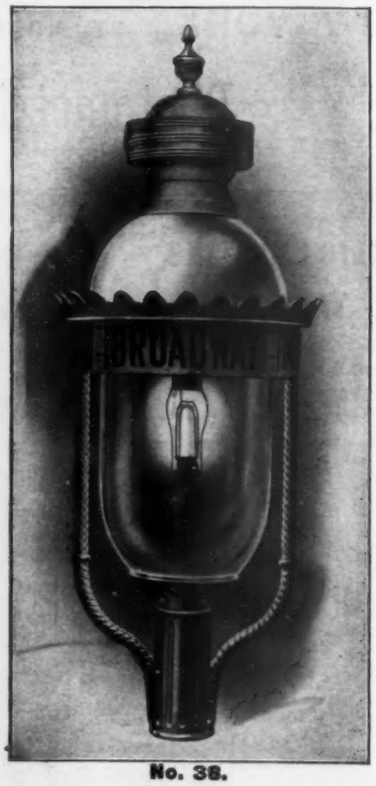
POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.



No. 38.

Welsbach Junior

THE BIGGEST LITTLE LIGHT IN THE WORLD.

The Welsbach Junior Light is 5 inches high--consists of burner, mantle and chimney--and is attractively boxed in a pasteboard carton.

As its effectiveness and economy become better known the Welsbach Junior will supersede, for universal use in the home, the old-style open flame gas burners.

Showing Welsbach Junior Light used in connection with ordinary glass globe.

Gives 50-Candle Power.

Uses Two Feet of Gas per Hour.

Attaches to Any Gas Fixture.

Completely Hidden from View.

Use your own globe--either gas or electric.

SMALL—EFFICIENT—ECONOMICAL.

Welsbach Company, FACTORIES: Gloucester, N. J. Columbus, O.

Salesrooms in all Leading Cities of the United States.

The United Gas Improvement Company,

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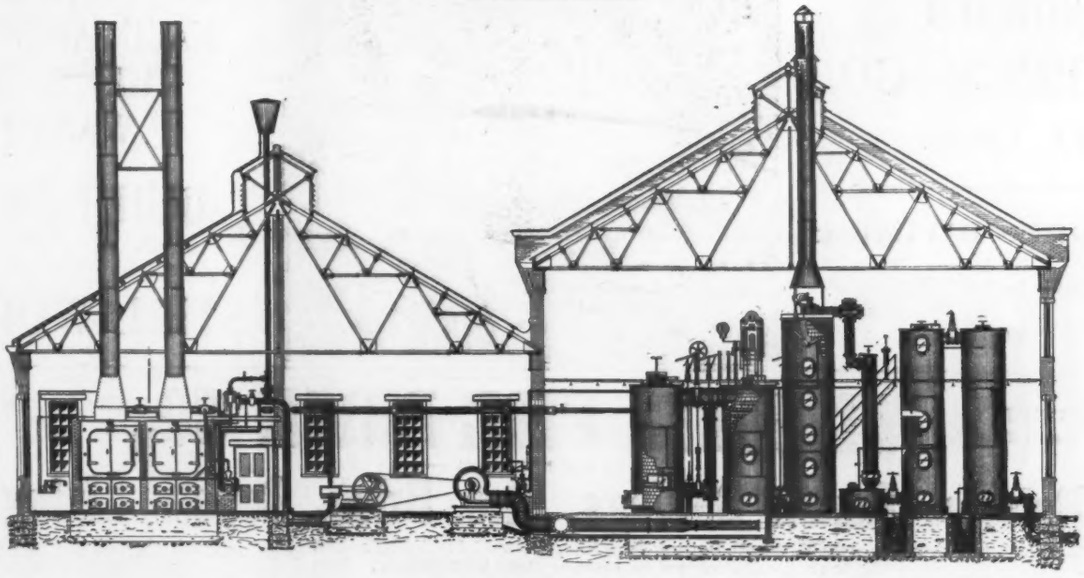
LESSEES, OPERATORS AND BUILDERS OF **GAS WORKS.**

Largest Builders of CARBURETTED WATER GAS PLANT IN AMERICA.

SOLE AMERICAN BUILDERS

OF THE

Standard Double-Superheater Lowe Water Gas Apparatus.



TOTAL SETS INSTALLED TO DECEMBER 31, 1908, ... 690
TOTAL DAILY CAPACITY, TO DECEMBER 31, 1908, ... 558,565,000 cu. ft.

Tar Extractors for Carburetted Water Gas.
Photometrical Apparatus.
Gas Analysis Apparatus.
Recording Gauges.
Straight Standpipe System for Coal Gas Retorts.
Straight Standpipe Cleaners.
Waste Heat Boiler.
Hygrometer.
Meters for Regulating Air and Steam Supply to Water Gas Apparatus.

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H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES, FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

KRATER-DINAS RETORT CEMENT.

Universally accepted to be the best cement for patching and repairing retorts, making up bench work, etc. Advantages: Powdered form; only mix with water; no waste; too much mixed, apply water and use the next time; adheres very easy; does *not* fall out by decarbonization. We guarantee or take back. Many re orders and recommendations from America, Germany, France, Belgium, etc. Write for price and testimonials.

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GEROULD'S IMPROVED RETORT CEMENT.

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

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In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 300 " " 6 " "
In Kegs less than 100 " " 7 " "

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29 North Mill St., New Castle, Pa.

"BEST BY TEST."
ESTABLISHED 1868.

L. N. RANCKE, V. Pres. & Mgr. E. L. RIEHA, Engineer.

BALTIMORE RETORT & FIREBRICK CO.
BALTIMORE, MD.

HIGH GRADE FIRECLAY MATERIAL FOR ALL PURPOSES.

DESIGNERS AND BUILDERS OF

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SUPERIOR GRADE LININGS AND CHECKERBRICK FOR WATER GAS SETS.

WE SOLICIT YOUR INQUIRIES.

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AGENTS FOR NEW ENGLAND STATES.

LARGE MODERN FACILITIES.
RAIL AND WATER CONNECTIONS TO ALL POINTS.

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AND
HOWARD
FIREBRICK CO.,
ST. LOUIS.

GAS WORKS DIVISION:
A. S. B. LITTLE,
ENGINEER.

YOU

CAN HAVE A FURNACE ARCH LIKE THIS IF YOU WANT IT.

BUILT IN 1902
AND
STILL WORKING.

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the **Exclusive Agents** *for the* **Mitchell Patent Benches,** *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* **Rear Clinkering.** **The Mitchell** *is the* **Original Coal Firing Bench.** *We also Erect Plain Benches with* **One** *to* **Six Retorts.**

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THE SEVENTH EDITION, ILLUSTRATED,
— OF THE —
Handbook for Gas Engineers and Managers,
By THOMAS NEWBIGGING, M. INST. C.E.

This Edition of the "Handbook for Gas Engineers and Managers" is a great improvement on all previous editions. Much of the text has been re-written, in order to keep the work abreast of the constant advances that are being made in the Gas Industry.

PRICE, . $6.50.

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Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y., Toronto and Montreal, Canada, Detroit, Seattle, Rochester and St. Louis.

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Hot **Coke Conveyor, Quencher and Steam Exhauster,** operating in Toronto, Canada, working in water-sealed flue, rollers being protected from heat and grit.

COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins. Coke Screening and Measuring Plants a Specialty.

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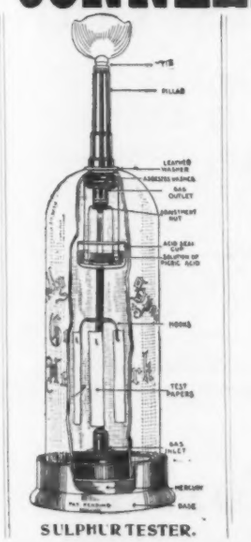

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Automatic, Balance, High Pressure and Service Governors,

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Iron Sponge, Purifying Material for Gas Purification, Manufacturers of Jones Jet Photometers, The National Smoke and Ammonia Helmet, Sulphur Testers, High and Low Pressure House Governors.

Wide Experience in High Pressure Installation and Extension.

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12-Inch High Pressure Governor.

REYNOLDS' GAS REGULATOR COMPANY,

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Double and Single District Stations,

And Individual Service Governors for Reducing High Pressure.

HOLDER GOVERNORS

And Low Pressure Regulators, all of the Dry Diaphragm type.

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is the best and surest means of keeping your name and product before the buyers. :: ::

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OLD KENTUCKY SHALE AND O. K. BOGHEAD.

BERWIND-WHITE COAL MINING COMPANY'S

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Carefully Prepared.
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Successor to WILLIAM GARDNER & SON.

Fire Clay Goods for Gas Works.

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These valves are provided with double discs or gates, and are tight with the gas pressure on either side of them.

The discs are so arranged as to be free from their seats when being opened or closed, and are operated by a quick-acting mechanism. The valve stem extends outside of the bonnet, and serves as an index, showing whether the valve is closed or open, and the amount of opening. They are made of the following dimensions:

Size.....	8 inches	10 inches	12 inches	16 inches	20 inches	24 inches	30 inches	36 inches
Diameter of flanges....	13 inches	16 inches	18 inches	22½ inches	27 inches	31 inches	31½ inches	44 inches
Face to face of flange...	12 inches	12 inches	12 inches	14 inches	17 inches	20 inches	21 inches	23⅝ inches

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Strong, Simple, Durable. Will Crush any Size Desired.

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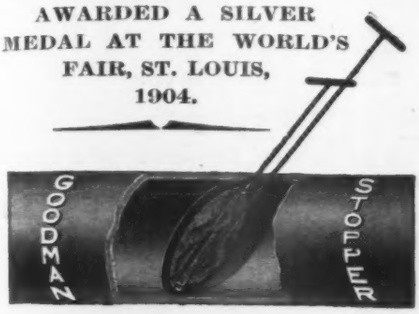

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Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

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Special Trays for Iron Oxide in Either Style.

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WITHOUT ANY ESCAPE OF GAS.

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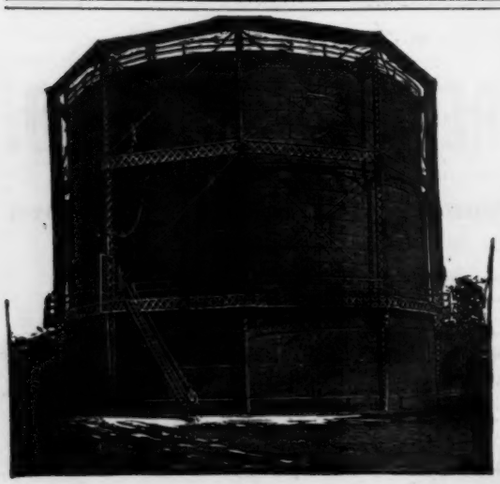

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Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

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COMPLETE EXAMINATIONS MADE. ~ ~ ~ PROPERTIES PURCHASED.

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McDonald-Mann chutes with cable car in position to receive the quenched coke, Cleveland Gas Light and Coke Co.

Some of the economical advantages of these chutes are:

The coke is quenched in closed bins.
Smaller amount of breeze than by any other method.
Minimum loss from incipient combustion.
Entire absence of steam and gases.
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Gas engineers, both designing and operating, should investigate this method of handling coke, and the names of the nearest Gas works using this system will be furnished to those interested in seeing it in operation.

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For District or Individual Service.

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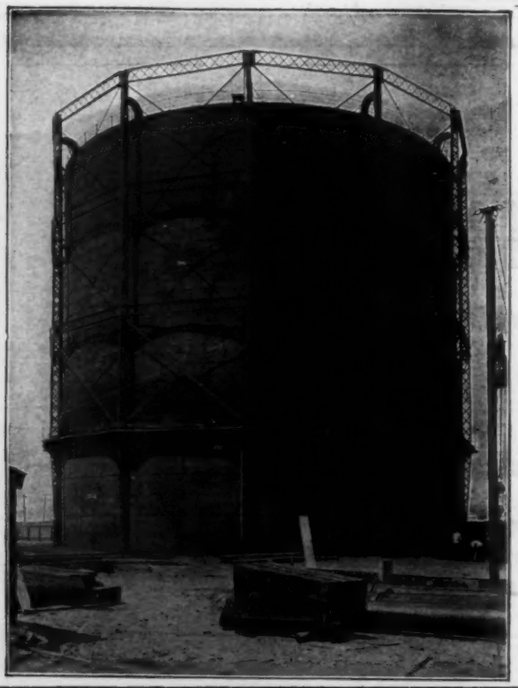

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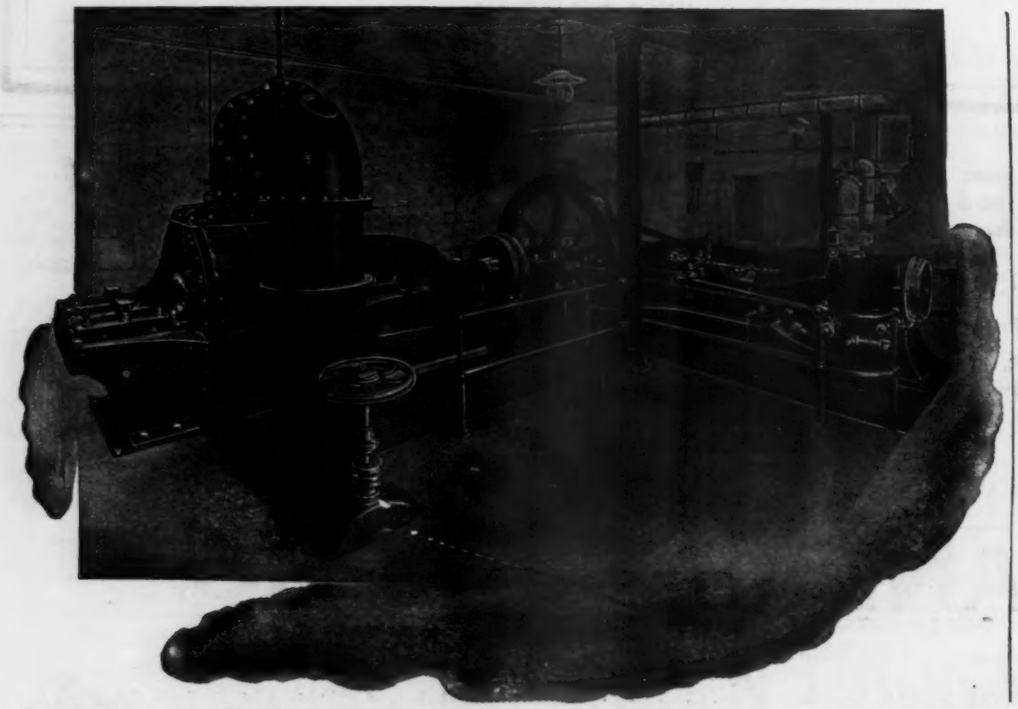

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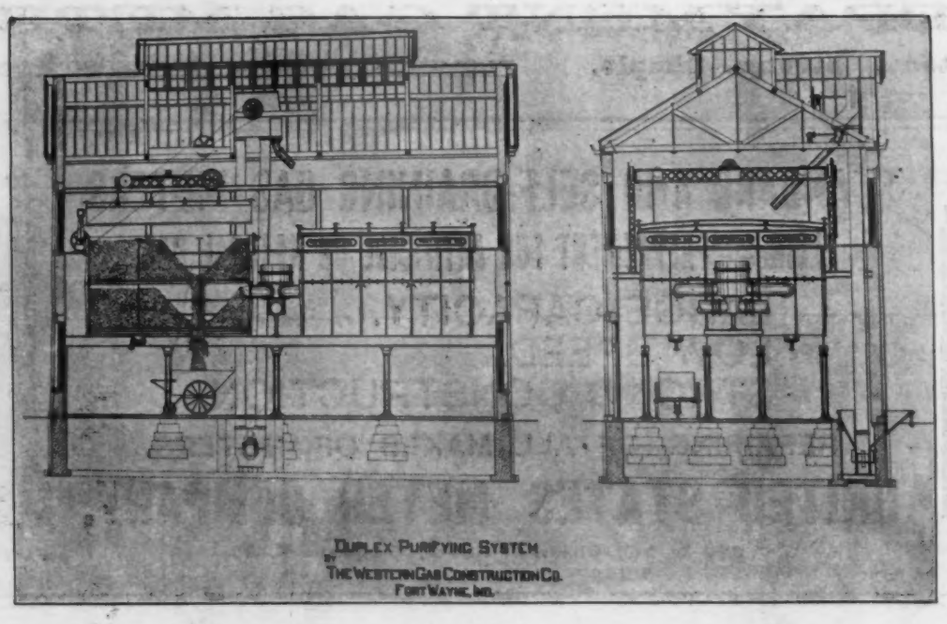

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